THE FOUNDRY for May

Increasing EMPLOYMENT

STEADILY advancing, activity in the foundry industry is giving employment to more men. The National Industrial Conference board reports on April 30 that the relative increase of foundry employment in March over February is 14.3 per cent, rating second to the automotive industry, the leader, with 16.7 per cent advance. The tide has turned. Many high type foundry foremen and superintendents are being re-engaged. A shortage of trained operating executives is not far away. To continue the nautical simile—see front cover of this issue—good navigation officers are needed. Their chart, guide and interpreter of latitude and longitude in the industry is and will continue to be THE FOUNDRY.

What Price TRADE NAME

A LEADING metallurgist of the foundry industry, an intelligent and fond student of overseas technical literature, rises to second a statement in the *Foundry Trade Journal*, official organ of the Institute of British Foundrymen on trade names. The viewpoint of the publication is briefly as follows:

". . . . trade names such as Ni-Resist, Nimol, Nomag, Meehanite, Nicrosilal and so forth, have been registered. This raises the question as to whether founders wish to suppress the basic fact that these alloys are fundamentally cast iron. Obviously, they wish to attach to the registered name as much goodwill as possible, and so may, erroneously we think, be tempted to suppress wherever possible the words, 'cast iron,' which the brand name qualifies. . . . It is readily understandable that, when firms are paying for extensive alloy additions or licenses to manufacture, they fear the buyers, habitually purchasing cast iron, may have the price range too well fixed in mind to accord proper recognition of the intrinsic worth of new raw materials."

Quite true, a trade name is worth, as a goodwill asset, the amount expended in advertising and promoting it. It may be exposed to discredit if any isolated producer is permitted, through lack of supervision, to supply a product under the trade name that may not measure up to qualities claimed. Its value decreases with the multiplication of many newer competing trade named products. It is exposed to danger of over enthusiastic claims and becomes a ready target for disparagement if it falls short of publicised perfection. All the points appear on the debit side of a trade name product.

Nevertheless, if trade names provide the *only* means for securing adequate return to the foundryman for additional cost in alloys, processing or heat treatment and if they are promoted by proper publicity and advertising, they are valuable. Too often the customer has been brought to demand alloys or special treatment to meet real or fancied specification requirements and has not been asked to pay for the increased costs. Some foundries have aided and abetted this condition through ignorance or mistaken competitive ambition. Might not all producers of special gray iron, and other classes of castings as well, take a lesson from those who have so ably promoted the use of their trade marked special products? Let the customer who needs or demands higher qualities and special treatment pay for the increased costs.

Don't Neglect PRACTICE

PHENOMENAL advances in foundry technical and manufacturing practice have been made in the past ten years. Those who have survived the economic storm have been involved and busy with management phases and the NRA during the past year. New emphasis upon the practice side is imperative in the immediate future. A valuable aid to continued progress is the recently announced plan of the American Foundrymen's association to foster local sections. This will stimulate and advance the interest of the industry in scientific and operating problems and broaden opportunities for the entire castings manufacturing industry.

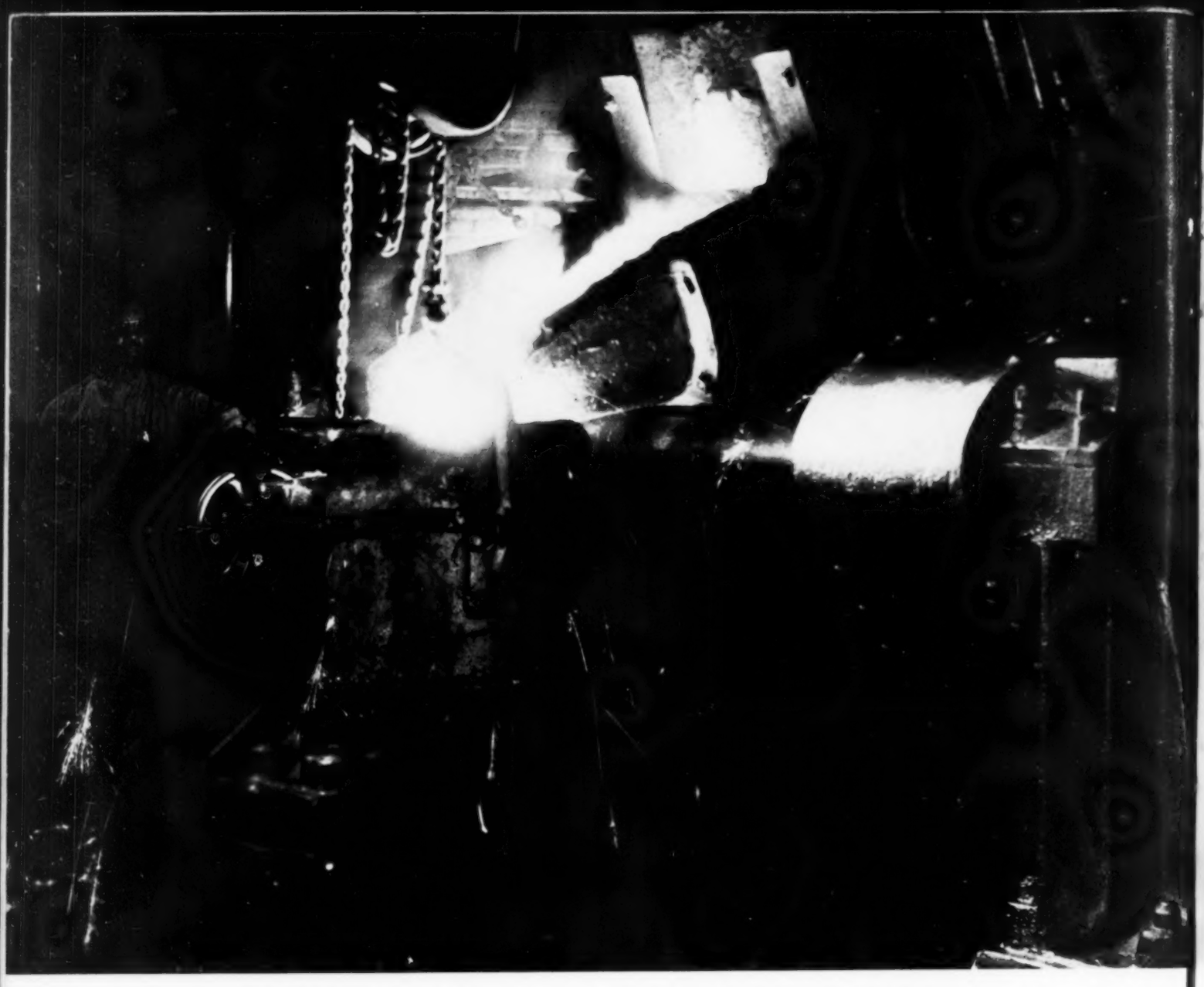


Fig. 1—A combination of blast furnace and cupola metal is superheated in an electric furnace

Simplify Casting of V-8 Cylinder

Through adoption of mechanical equipment the foundry loss is held under 2 per cent

By PAT DWYER

REMARKABLE evidence of the extent to which engineering skill and scientific control have invaded the foundry field in recent years is presented in the methods employed in the production of V-8 automobile cylinder blocks at the plant of the Ford Motor Co., Detroit.

The present type of cylinder block was designed to meet two definite demands. One was the production of a compact and rigid structure with a smooth, clean skin. The other was a reduction in the total number of parts required in the complete engine and a consequent reduction

in handling and machining costs. The cylinder block proper is combined with the upper half of the crankcase. Exhaust ports for right and left series of 4 cylinder barrels are combined in the casting, thus introducing further complications from the foundry standpoint, since double coring for water space is required between the cylinder barrels and port passages. The net result is a lighter engine and one much more accessible for assembling, maintenance and repair.

Methods of control and operation, equipment designed to insure precision and accuracy did not spring up full armed and complete in a single day. As with practically every foundry innovation, unforeseen obstacles continued to pop up at intervals for some time after the first batch of castings was attempted. Constant, persistent and closely focused specialist attention eventually removed all the knocks, squeaks, rumblings and back firing in making of the castings. At present the system is operating as smoothly and efficiently as any one of the finished products under the hood of a new car. A typical monthly report shows that defective castings amount to less than 2 per cent of the total number of castings produced. This is the more remarkable when the output is taken into consideration, 3000 per day in January, 3500 to 4000 in February, March and April and an anticipated daily production of 5000 in the near future.

Secure Smoothness of Operation

Smoothness of operation and high production have been secured through an almost total elimination of the hazard incidental to the human element. Men are employed in great numbers. They cluster as closely around each mechanical unit as bees in a bee hive, but the sequence of operation in the construction and assembling of the molds and cores has been divided and subdivided to such an extent that the part each man contributes to the cycle does not involve intensive mental application, or the manual skill and dexterity which only may be acquired over a long period of special training.

A predetermined production pace is set by the moving mechanical equipment. Under these conditions even a green operator rapidly becomes adept in performing his limited and simple quota. Special equipment including extremely accurate jigs, gages and fixtures insure practically perfect uniformity in the assembling of molds and cores.

Nothing is left to chance or to the discretion of any individual operator. A part passing his station either is perfect or is not perfect. If it is not perfect, it is immediately discarded. The same policy based on experiment, investigation and extended experience is maintained in the preparation of the molding and core sand, the composition of the iron mixtures and the operation of the melting units.

Iron for the cylinders is held to the following approximate analysis: Silicon 1.80 to 2.10 per cent, sulphur 0.10 per cent maximum, phosphorus 0.25 to 0.32 per cent, manganese 0.60 to 0.80 per cent, total carbon 3.20 to 3.50 per cent. The iron is a mixture of cupola melted iron, and direct metal from the blast furnace poured into a 400-ton mixer. The resulting mixture is drawn off 15 tons at a time and superheated in an electric furnace. The superheated metal then is drawn and conveyed to the pouring station in 1500-pound ladles, sufficient to pour four molds. Each mold takes approximately 300 pounds for casting, gates and pouring basin. The finished cylinder block weighs 190 pounds. The cupola charge is made up of back stock and pig iron 85 per cent, and steel scrap 15 per cent. Detailed description of the melting, mixing and superheating installation appeared in THE FOUNDRY, Sept. 15, 1927.

Eliminate Risers on Casting

While on the subject of weights it is interesting to note the effect of a minor change made recently in the risers. For some time the castings were provided with four risers, one on each of the upper corners of the crankcase. Iron in these risers weighed 10 pounds. Close observation over a considerable period seemed to indicate that these risers were not necessary and thereafter they were omitted. On a basis of 3500 castings per day, the saving in the amount of iron required is 35,000 pounds.

Large number of cores and intricate character of several in the group for a cylinder block are shown in the display of Fig. 3, where *B* is the valve housing core, *C* right and left barrel cores, *D* lower water jacket cores, *E* center jacket cores, *F* upper jacket cores, and *G* upper crankcase core. Each set of barrel cores with accompanying water jacket cores is assembled as a unit as shown in Fig. 5, before it is placed in the mold.

Barrel cores are rammed in the opposite position to that shown in Fig. 3. Metal core boxes are mounted on an oval roller conveyor which carries them in turn under a sand slinging machine and a group of three pneumatically operated vertical plungers. The rammed core is held momentarily under the first of the group while the plunger pushes slightly smaller tapered plugs into the sand directly above the centers of the barrels. The second machine forces an arbor into each barrel. The arbor is made of special shaped steel perforated. An operator inserts a pipe in the top of each opening and then the third machine forces the pipe all the way down.

These pipes constitute the only reinforcement in the core, which is made from a mixture containing nearly all old sand bonded with a proprietary pitch base binder. Having passed the plungers, a core plate is laid on the flat surface and the corebox is inverted and withdrawn and once more placed in circulation. The core with supporting plate is dipped mechanically in a blackwash tank and then placed on one of the shelves of a traveling upright conveyor which carries it through an oven in 2 1/3 hours for drying. The dried cores are removed, placed on a

Fig. 2—Core assemblies are gaged and checked minutely

storage conveyor to cool and then delivered on another conveyor to the core assembling stations.

Upper and lower water jacket cores are made from a fine grade of lake sand bonded with oil. Mixture for the center water jacket core contains a small amount of bank sand to impart the necessary green strength and prevent the core from sagging while passing through the oven. The various cores to form the unit shown in Fig. 5 are assembled by a group of operators stationed beside a waist high conveyor as shown in Fig. 2. Duty of each man is confined to a single operation and in that manner the cores pass in a constant rapid stream. The barrel cores with slab attached are placed on a revolving conveyor where the remainder of the assembly is built up in the following order: Lower jacket core, four intake and three exhaust port cores, middle jacket core, top jacket core, and all joined.

A thin layer of paste is applied to the adjoining faces of the jacket cores by placing them on a device which lowers the core into a paste bath. A templet prevents the paste from touching the vent passages or the areas near the edges of the core. The vents are made by inserting steel wires in cores to make passage for gas travel. Perforated chaplets are placed between the cores in certain areas where the unsupported part might not be strong enough to resist the pressure of the metal.

In addition to the paste the entire assembly is bound firmly together by a number of light bolts which extend through suitable small openings from top to bottom. A recess at the top receives the toe of the bolt, while a similar recess at the bottom receives the washer and nut. After the bolts have been pulled up tight the recesses are filled with talc moistened with oil.

The completed cores are loaded on an adjoining conveyor which carries them through an oven where the paste and daubing material are dried. Upon emerging from the oven the cores pass under an automatic counting device which registers the daily production, and thence to racks in the vicinity of the mold assembling stations.

Cores Made on Turntable

At first the crankcase cores *G*, Fig 3, were rammed by groups of men equipped with pneumatic rammers. Later a sand slinging unit was installed with the usual turn table on which the battery of coreboxes are filled, and emptied in constant procession. Each core is reinforced with a number of long and short rods and the center is filled with coke.

The small round opening near each end is the sprue and the gap extending from either side of the sprue at the upper end in the illustration is the runner which discharges the metal to a number of small shallow gates formed in the mold core print.

Metal from the ladle lip falls into a green sand pouring basin extending from the edge of the cope to a point slightly beyond the center where two sprue openings in the bottom of the basin coincide with corresponding sprue openings in the cope. Three sprue openings in the cope

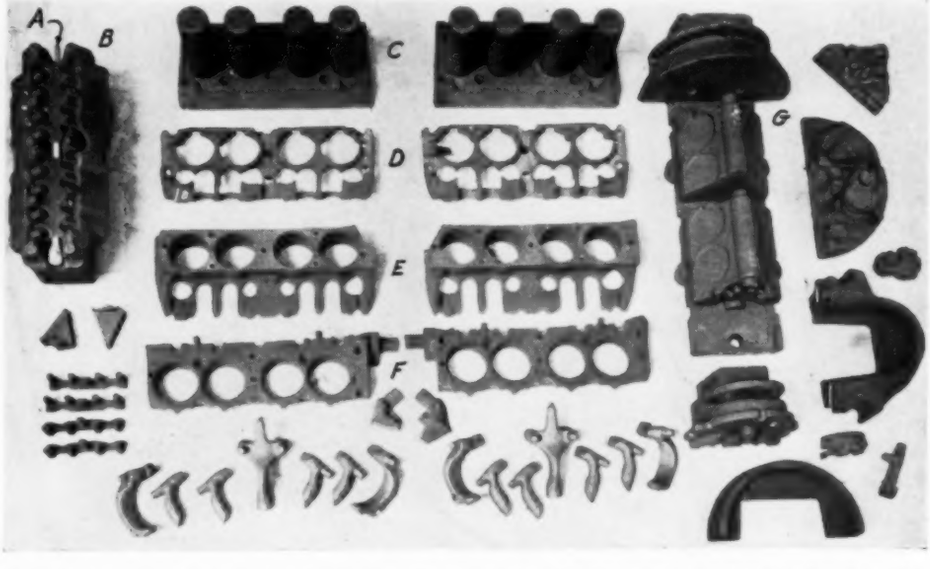


Fig. 3—A complete set of cores for a V-8 cylinder block. The steel oil tube A is incorporated in the valve housing core B

carry the metal to a horizontal runner formed in the under face of the cope, and which in turn delivers the metal to the two sprue openings in the crankcase core as shown in Fig. 3. The pouring basins are formed two at a time on a small jolt machine located close to the point where the closed molds pass on their way to the pouring station. A small sheet of paper is placed over the sprue opening in the cope before the pouring basin is placed in position. This serves to catch any dust or sand particles and prevents them from entering the mold with the first iron. Usually it is not needed and merely represents the final touch, an added grace note to a symphony of carefully directed and supervised effort.

Prevents Cope from Shifting

Molds for the cylinder blocks are made in cast steel flasks with gaps in the sides of the drags and corresponding projections on the sides of the copes to conform to the parting line on the cylinder pattern. The joints are ground to a true plane and the pin holes are bored through a jig which renders the flasks interchangeable. Long pins are employed for guiding the cope into place on the drag. These pins then are removed and replaced by shorter pins which remain in place until after the casting is poured. These short pins prevent the cope from shifting during the application of the clamps or while in transit to the pouring station. Just another of the many minor precautions toward the production of a perfect casting. For the same reason the somewhat remote contingency of pulling the bottom plate up too tight is prevented by the insertion of a thin shim at each corner between flask and plate. Thickness tolerances on many parts of the casting are held to 0.010-inch.

Fig. 5—The base, barrels, water jacket and port cores are pasted and bolted together and handled as a unit

Molds are made on several units in close proximity to a long conveyor which carries them in turn to the pouring station, through the cooling hoods and to the shakeout station. Each unit is similar to the others in that it includes equipment for forming a definite number of molds per day of 8, 16 or 24 hours, thus providing an extremely flexible medium to meet fluctuating production schedules. Each unit is made up of two subunits, one for the copes and one for the drags. With a few minor modifications, the equipment and method of procedure are similar in each of the subunits.

Four duplicate patterns are mounted in front of a sand slinging machine. Flasks are placed in position over these patterns, filled with sand and removed in regular succession. An aluminum bottom plate is attached to each drag before it is rolled over, but since the cope is barred, this precaution is not necessary. The cope is lifted from the machine and rolled over to facilitate blacking the surface with a spray gun. The mold surface of the drag is blacked in the same manner.

The mold part, either cope or drag, is lifted and placed on a short, slow moving U-shaped conveyor, about 20 feet to each leg. The molds travel under a steel hood and under a succession of flaring gas jets which effectually dry the

(*Please turn to page* 52)

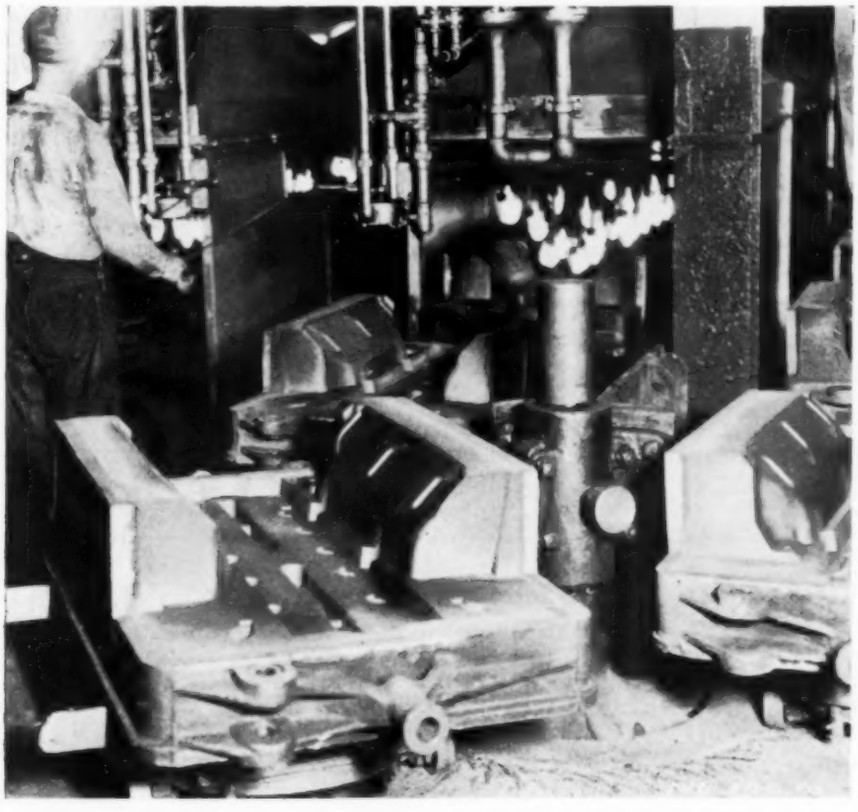


Fig. 4—Copes are skindried in transit under a battery of gas jets

What Should Govern Cupola Slag?

Low fusion point and a sufficient quantity for proper control are important factors

By FRED J. WALLS
Eaton-Erb Foundry Co., Vassar, Mich.

MATERIALS charged into the top of the blast furnace or the cupola produce molten iron, slag and gases. The slag formed is derived from the earthy oxides charged into and picked up from the walls of the furnace, composed principally of silica, alumina, calcium oxide and magnesium oxide together with small quantities of the oxides of iron and manganese.

In the case of blast furnace operation it is from the regular flushing of slag from the furnace that the superintendent and his assistants form opinions of conditions of the furnace operation and of the quality of the iron which it will produce on the succeeding cast. Their opinions are based on the color, fluidity and texture of the slag and the characteristics of the gases expelled from it at the cinder notch and while the molten slag is flowing along the trough. Fortunately for the operators, slags have quite a latitude in the relation which silica, alumina, calcium oxide and magnesium oxide bear to each other without seriously interfering with the slag fluidity. However, a combination of these elements which will give the lowest possible fusion temperature requirements of the slag, allows a greater superheat above that fusion point at the tuyeres and hearth. This superheat adds to the fluidity of the slag and uniformity of the furnace operation. Of course regular furnace operation means much to the quality of the iron produced and economy of the operation.

It will be entirely out of line with the subject of this article to go further into the matter of blast furnace operations than to state that all factors are kept as regular and uniformly perfect as possible at all times. All of the raw materials charged into the furnace are sampled and analyzed thoroughly against which the production of iron and slag is checked carefully. The cause of any material change in either must be found and accounted for promptly.

Each of the elements in question (silica, alumina, calcium oxide and magnesium oxide) when taken alone has a very high softening or fusion point. For instance silica requires approximately 2950 degrees Fahr.; alumina 3600 degrees Fahr. and calcium oxide and magnesium oxide still higher. Fortunately there is a natural law that when two or more of the elements are mixed together the fusion point is lowered in proportion to the percentage of each of the elements in the mixture. All of these natural conditions should be taken into consideration as far as possible in selecting the burden of ore coke and limestone for the blast furnace as well as the selection of the semi-raw materials for the cupola. However there are more unknown quantities of foreign matter present in the latter such as iron oxide in the form of rust on scrap and occasionally on pig iron a portion of or perhaps all of the melting zone patch, etc., while the known quantities are or should be the coke ash and the fluxing value of the limestone. With these two known quantities one can calculate the amount of limestone required to flux the coke ash but it is difficult to determine the quantity of the unknown elements of the charge from which to calculate a theoretical slag.

Quantities of Materials Charged Form Basis for Calculations

	Pounds	SiO_2		Al_2O_3		CaO		MgO		FeO–MnO, etc.	
		Per Cent	Pounds	Per Cent	Pounds	Per Cent	Pounds	Per Cent	Pounds	Per Cent	Pounds
Metal Charge.....	517,500										
Coke	66,850	4.48	2,995	2.37	1,584	0.95	635	0.80	535	0.90	602
Limestone	14,950	3.85	576	0.50	75	47.40	7,086	4.30	643	0.40	60
Totals	599,300	.....	3,571	.....	1,659	.....	7,721	.....	1,178	.....	662

Calculates Formation of Slag in the Cupola

CERTAIN similarities exist in the slags produced in the operation of the blast furnace and those which must be considered by the foundrymen in the melting of iron in the cupola. Recognition of the important functions slag must perform and the proper selection of materials to produce the particular properties necessary for the conditions present, will aid greatly in providing control of melting conditions and of the molten iron produced. This article which advances some conclusions on the formation and characteristics of cupola slags with respect to importance in quality and quantity, is from a paper read at the recent foundry short course conducted by the mechanical engineering department of Michigan State College of Agriculture and Applied Science at East Lansing, Mich. The calculations are based on data taken from regular cupola operation.

In making up a cupola charge it is important to create a slag which has as low a fusion point as is consistent with conditions present. At the same time quantity of slag should be sufficiently large for cupola operation control, to cover well the bath of molten iron in the hearth and to act as a secondary cleanser for the molten iron passing through the slag. It must be borne in mind that pig iron is only a semifinished product and scrap bought on the open market should be considered about the same because of its wide variation in analysis, rust, dirt, etc.

To show the unknown variation in cupola slag formation a theoretical burden calculation on one day's full operation has been made, using the known quantities for a basis, which is as follows:

Molten iron produced.....	254 net tons
Number of charges.....	115
Metallic charge 4500 pounds x 115 charges..	517,500 pounds
Coke charge 550 pounds x 115 plus 3600 pounds on the bed.....	66,850 pounds
Limestone charge 130 pounds x 115.....	14,950 pounds

The data on which the following calculations are based are presented in the table on page 18.

Total SiO_2 in charge.....	3,571 pounds	
Silicon loss of 0.10 per cent to silica	1,108 pounds	
Total SiO_2 in slag.....	4,679 pounds	29.43 per cent
Total Al_2O_3 in slag.....	1,659 pounds	10.44 per cent
Total CaO in slag.....	7,721 pounds	48.56 per cent
Total MgO in slag.....	1,178 pounds	7.41 per cent
Total FeO-MnO, etc., in slag	662 pounds	4.16 per cent
Total slag	15,899 pounds	

This calculation shows that there was 15,899 pounds of slag formed from the known elements in the coke and limestone charged, or 62.8 pounds per ton of iron melted. This slag is extremely basic and at extremely high temperatures it would be very sluggish, or in other words it would be lacking in fluidity, would freeze rapidly and disintegrate or slack readily when cold. Its fusion point is approximately 2550 degrees Fahr. If the temperature at the tuyeres of the cupola was 2800 degrees Fahr. this would give a superheat of 250 degrees Fahr.

Samples of slags were taken during the operation in question at regular intervals during this particular day's operation, the samples being thoroughly prepared, mixed and analyzed, which showed the following results:

	Per Cent
SiO_2	44.23
Al_2O_3	13.43
CaO	31.72
MgO	4.84
FeO, MnO, etc.	5.78

This shows that during the day over four tons of foreign matter was picked up, either from the melting zone patch or from the materials charged or both and was converted into slag. The following calculation shows the amount of each element necessary to produce a slag of that analysis from this operation:

	Pounds	Per Cent
SiO_2	10,769	44.23
Al_2O_3	3,270	13.43
CaO	7,721	31.72
MgO	1,178	4.84
FeO, MnO, etc.	1,407	5.78

or a total of 24,345 pounds which is equal to 95.8 pounds of slag per ton of iron melted.

The amount of slag forming materials picked up was as follows:

	Pounds
SiO_2	6,090
Al_2O_3	1,611
CaO	Nil
MgO	Nil
FeO, MnO, etc.	745
Total	8,446

a gain of 53 per cent.

This slag has a fusion point of approximately 2100 degrees Fahr. in which case, assuming the temperature inside the cupolas at the tuyeres, as in the case before, at 2800 degrees Fahr. the superheat would be 700 degrees Fahr. or an increase of 180 per cent over that of the first calculation. The acidity of this slag undoubtedly would indicate considerable fluidity at temperatures fairly close to its fusion point.

By computing a slag volume for a short heat, using 20 charges instead of 115 and 2600 pounds of coke bed instead of 3600 pounds, little difference was noted in the results. The pickup showed a gain of 51 per cent or 1605 pounds instead of 53 per cent in the first calculation.

By adding 25 pounds of sharp sand to each charge, the slag volume would be increased to 107 pounds per ton of iron melted, the calculated analysis of which would be:

	Per Cent
SiO_2	49.3
Al_2O_3	12.5
CaO	28.5
MgO	4.5
FeO, Mno, etc.	5.2

The fusion point of this would be slightly lower than the previous one mentioned.

In blast furnace operations it sometimes occurs that a scaffold forms in the bosh or a few feet above the tuyeres. (*Please turn to page* 48)

To secure qualified men of the future, foundry owners must take a greater interest in training them

Faces Shortage of Trained Men

Lack of educational programs during past four years has limited supply of executives

By GOTTFRID OLSON

FOUNDRY work in the past generation has fallen into disrepute. Formerly the molder was considered a craftsman of high rank. With the advent of the molding machine, the molder stepped down and was no longer looked upon as an exponent of craftsmanship. This has resulted in a shortage of foundry workers, from the molder to the executive.

Going back a little farther—two generations or more—molding was not what we today call a trade. It was a craft, a word with a somewhat different meaning than it has today. Molding was considered an art, at least in the old world. Artisans were bonded closely together in castes or guilds and the business always went from father to son.

Simultaneously with the introduction of the molding machine we find the first attempt to systematize production in other industries. Frederick B. Taylor may be considered the father of our present system of production control even though the systems used in many industries today vary one from the other and from the original Taylor system. Taylor was the originator, the pioneer. Contemporaries include Dwight Merrick, Carl Barth and Chris Berg. All these men attempted to bring system out of chaos and in many instances they had to fight not only labor but employer. Some employers could not see the advantage of keeping shop records or to figure time in smaller units than the hour.

Production Increased Phenomenally

Most of us have seen automobile exhibitions where the new is displayed with the old. We marvel at the advance of the past 40 years. The first American automobile was built by Charles E. Duryea in 1892. Henry Ford built one in 1893 and Elwood Haynes in 1894. Up to that time, 40 years ago, the United States could boast of only these three cars and one Benz, brought over for the Chicago World's Fair in 1893. In 1900 the total world production of automobiles was 4192 and in the peak year, 1929 it was 5,261,715 including trucks.

Foundrymen share to a considerable extent in the advancement and perfection of this Twentieth century marvel. To realize this fully, one must go back to the early nineties and try to visualize a foundryman making a set of castings

for one of the present 1934 automobiles.

There is just about as much resemblance between the 1934 automobile and an old Ford or Haynes as there is between the 1894 molding machine and present day machines. The foundry industry has kept step with the march of progress and in no way should be looked upon as not worthy of at least equal consideration in judging its contributory influence upon Twentieth century development.

As more and better machines were built and put to use, the percentage of molders, real mechanics, diminished. Castings were produced in large volumes by machine operators.

Through the adoption of plate and machine molding and by dividing the foundry into sections for different types of work, the molders have been grouped into the following classes: Loam; heavy floor; side floor; bench; squeezer (gated patterns); squeezer (plate patterns); machine (gang); machine (individual).

Molder Becomes a Specialist

With these sharp divisional lines drawn it is only natural that the individual molder becomes more or less a specialist, the same as the man on a production line in an auto plant or in a shoe factory. He loses his identity with the molder of 50 or even 25 years ago. Foundries of today do not turn out allaround mechanics and this is one reason for the shortage of good men to fill responsible positions under normal conditions in our foundries.

During the present transition period the tendency has been to go to our institutions of learning for executives, particularly for specialty shops. This practice of choosing non-practical men to operate the foundry seems to have gained foothold even in shops not strictly in the specialty class.

A man with a college degree is brought into the shop and given a job in the foundry office to acquaint himself with the work handled in the shop. From the office he is transferred to the shop for a few weeks usually under the stewardship of the metallurgist for part of this time. He follows operations in the melting department, not with the idea of taking over supervision but merely to obtain a superficial knowledge of the work and equipment in this important part of the foundry.

The future executive then is placed in charge of one section of the foundry and shortly thereafter he is advanced to the superintendency. The foregoing is typical of the career of many men in responsible foundry positions today. Probably the system is not peculiar to the foundry.

Others have moved into the superintendent's or foundry manager's office without going to the trouble of learning the fundamentals through direct contact with the work in the shop. A third type of foundry executive has been elevated from a clerkship without either practical or technical training. These three types of foundry executives may be grouped in one class—insufficiently trained.

To a considerable extent, the molding machine is responsible for this method of selecting men to fill executive positions in the foundry. In the highly mechanized foundry no need exists for a man who knows how to make a parting or to ram a mold by hand. In ramming a mold on a machine, the question of skill is left out entirely. The work can be supervised best by a man conversant with physics and mathematics. A trained molder makes a poor machine operator. Any person who has had experience with machine molding knows that it is easier to make up a gang of machine molders from *green stock* than it is from men accustomed to hand molding.

Many foundries today are in charge of men who do not know how to make a parting, to set a gagger or to ram a mold. This is not said in a spirit of criticism but rather as an acknowledgment of fact. Without doubt many foundries can be as well and perhaps better managed by this type of executive. The man in charge of a specialty shop may be highly competent although he lacks training as a molder.

In the great majority of jobbing foundries, where all sorts of hand molding as well as some machine molding is carried on there is little room for a specialist. Obviously to handle work in a jobbing foundry successfully, no matter what size, practical training is of utmost importance.

Should Not Venture Into Strange Fields

The three outstanding types of specialty foundries, car wheel, stove plate and automobile require men highly trained in the respective fields. It does not necessarily follow that a good stove plate, auto, or car wheel man will measure up to requirements in a jobbing foundry. When a man trained in a foundry specializing in a particular type of castings, strikes out into a new field the foundry industry suffers, both directly and indirectly. Directly, because the man accepting a position outside his own particular field cannot give the same valuable service to his new employer as he did to his former owner. Indirectly because he is a living example that it is not necessary to start at the bottom, that is, actually spend at least some time working as a molder to qualify for a higher position.

Instances of this kind prevent many young men from wanting to learn the trade; from wanting to go *from the bottom up.* There is no incentive for an ambitious young man to enter the foundry with a view of learning the trade as a first step to becoming profitably and interestingly engaged. What is the use of working as an apprentice when he can go through college and get a good job without shoveling sand or carrying iron? As long as the employer puts his stamp of approval on this method of selecting his foundry execu- (*Please turn to page* 48)

Future of the Foundry Industry

Exchange of information provides stronger basis for meeting present and future problems

By DR. H. W. GILLETT
Battelle Memorial Institute

ACCORDING to F. A. Lorenz Jr., of the Durable Goods committee, one out of four of the small steel casting plants is fearful that it will have to go out of business. Such a situation, at a time when the country as a whole is supposed to be on the road to recovery, calls for some serious thought about the future of the foundry industry.

Manufacturing industries today are faced with an unusual set of conditions. To spread employment, they are forced to employ a larger number of workmen for only a part of the former normal number of working hours, and pay them increased wages per hour. That tends to bring in a considerable proportion of poorly skilled and relatively inefficient men.

That condition would remedy itself in time, and our real worry is uncertainty as to what restrictions next may be imposed upon industry under the present regime of regimentation. There seems to be no limit to the extent to which the brain trust wishes to decide for our citizens what those citizens may do.

Uncertainty of the situation is well illustrated by the Wagner bill. While it seems unlikely, in view of the terms of settlement of the automobile trouble, that the highly one sided original draft will be perpetrated, yet everybody wonders whether the snake is only scotched and not killed. The existence of this feeling is as bad a thing as was the bill itself.

As *Iron Age* put it, the New Deal would mean more if the administration would leave the same 52 cards in the deck long enough for the players to tell one card from another. Or, as *Saturday Evening Post* said recently: "We see the administration springing a new panacea every morning on a bewildered public and demanding the passage without delay of a preprepared bill by a yes-sir Congress."

We are walking over shifting sands and we do not know whether a good hard beach or a quicksand is ahead. Under such uncertainties, and with constantly diminishing freedom to operate the businesses they have built up, manufacturers nevertheless are supposed to produce profits that may be taxed to supply the wherewithal for the support of nonproducers, whether of the deserving type or the loafer type.

The manufacturer is between the upper and the nether millstone. Among manufacturers, the foundryman is hard hit as any. Class legislation has been invoked to aid the farmer, who is being paid money collected from the rest of us or to be collected from our descendants, for not raising crops. This planned economy does not contemplate paying the foundrymen for not producing castings.

Foundrymen are not forgotten by the tax-collector, but along with other thrifty and hard working classes, they fall into the huge group of men forgotten by the other agencies of the administration. The strong political machine that is being built up bids fair to continue these conditions for a long time to come before the pendulum swings back to the constitutional principles that have guided our past development.

Foundrymen Operate Under Difficulties

All this may be for the greatest good of the greatest number; the *crack-down* policies of today may be approved permanently by our citizens, and those who feel as do the authorities cited may be a tiny minority due for rapid extinction. Nevertheless, the most enthusiastic *New Dealer* who will take the trouble to consider the foundry industry can hardly deny that the foundryman must continue to operate under difficulties and handicaps before the New Deal millennium arrives and planned economy has wiped away the troubles of all classes. The foundryman apparently will have to grit his teeth and hold on as best he may.

How is an industry going to survive under such handicaps? There seems to be but one way to do it, and that is to follow the example of the industry that seems most clearly on the upgrade, the automobile industry. That industry is noteworthy for not being satisfied to do things the way they formerly were done. Today's cars are safer, swifter, easier riding and cheaper

than yesterday's cars. Gears shift easier, finishes stay bright longer, and almost every detail shows improvement. The basic reason for this improvement is that technicians are studying every detail to make it better and to produce it more cheaply. By a system of patent pooling and by such organizations as the Society of Automotive Engineers, information on how to do things better, obtained here and there, soon becomes common knowledge, and is utilized promptly by all. Even if full details are not passed on among the competing organizations, it does become known that a problem has been licked and the technicians are turned loose till they too have found the same or another solution.

It is a far cry from the huge automobile corporations to the small foundry, yet some of the principles that make for success may carry over. It seems that the way for the foundryman to survive is to be dissatisfied with the old ways of doing things, to look for new knowledge, and to apply it. If this is correct, where can he find, and how can he apply, new knowledge? You may expect me, as a member of an organization devoted to industrial research, to suggest that research departments be set up, as the automotive people have done, or that research projects be farmed out to organizations like Battelle. That is certainly the thing to do when existing knowledge reaches its limit and problems arise that cannot be answered without diligent study of those particular problems. But in general, there are other steps to be taken before that stage is reached.

Men in Industry Swap Information

The foundry industry is an old one and there are a great many foundries. In all countries there are foundrymen who are up on their toes, who have met, defined, and solved problems. These men seldom wish to hold secret the advances they have made. They have a pride in their work and they are willing to pass on to others the things they know. Some may not be altruistic enough to do this with no hope of gain, but in general they are shrewd enough to see that if they can swap ideas and experiences with a dozen of their fellows, in the long run they get more than they give.

There are two main sources of technical foundry knowledge, neither of which can be disregarded. One is the accumulated experience of the melter, the molder, the core maker and so on, who, by handling foundry materials day in and day out, learn their idiosyncrasies, come to know what they will and will not do, and how to make them produce good castings.

The value of that type of knowledge has been stressed most interestingly in a recent book called *Steel Makers*, by the English metallurgist, Harry Brearley. He went to work in a crucible steel plant in his very early teens and had no formal technical schooling, indeed no schooling at all worthy of the name, but was wholly self-taught. He became interested in the chemical analysis of steel and in the utilization of analytical data, and became a world renowned chemist and metallurgist through his own application of the knowledge he gained from his own observation, from other workmen and from books. In his book he raises questions as to the efficiency of modern educational systems, arguing that they tend to stifle initiative, and pleads for greater consideration of the possibilities of education through the use of the hands in actual work.

His self-education certainly gave him an independent outlook, and his delightfully written book shows that good English can be acquired by reading just as his own career shows that some people can become able metallurgists without formal metallurgical education. Metallurgists will find in the book not only a fascinating picture of the fast-vanishing crucible steel industry, but much food for thought, even though they will seldom agree completely with the author's point of view.

Unite Formal and Practical Knowledge

Indeed, the very books from which he learned the chemistry and metallurgy which he supplemented by his own observations, were, of course, the product of the normal method of scientific education.

I have digressed to make reference to Brearley's book to bring out more clearly that given the interest, the will, the time and access to suitable literature, much of the world's store of foundry knowledge can be assimilated and utilized by foundrymen who have not had formal technical training, and to emphasize as well the fact that such knowledge must be married to the knowledge of practical foundry experience before the two can have offspring in the shape of maximum foundry efficiency.

But in general the foundryman who has not been brought up so that he can easily assimilate the stock of technical and scientific information that is available lacks the time to give himself that training. What he needs and what he must have if his foundry is to benefit by modern knowledge is an interpreter, one who knows where to find it and how to pick out from it those items that could be applied in that particular foundry.

Any interpreter must know both languages, so the technically trained man must be taught the language of actual foundry experience. A man with a sound scientific training, whether he has specialized in metallurgy, chemistry, physics or engineering, should be in position to pick up the specific technical information needed in the foundry in fairly short order, even though it has not been taught him in detail in college. Such a man, given an apprenticeship on the molding floor, in the core room and at the furnaces, and serving as an inspector (*Please turn to page* 51)

Fig. 1—Large pins with ornamental flat heads for holding clothing together Runners, gates and a hollow axe head are shown to the right

Discover Ancient Bronze in Sweden

Excavations of small mound reveals castings and crucibles dating back about 3000 years

By SIXTEN O. V. NILSSON
Swedish Manufacturers Association

SEVERAL years ago a peasant or small farmer living near Enkoping, a little town not far from Stockholm, Sweden, sought permission through the state historical institute, to remove a small hill from his field. The hill was believed to be a grave from the olden times.

Many of these small hills are found in this part of the country, but few have been investigated, because only rarely has anything of historical value been found in them.

In this instance the peasant was granted permission to proceed with the work, but was notified to report immediately if he found anything remarkable during the excavation process. A month later he sent word to the institute that he had unearthed a considerable number of interesting relics dating back apparently to the so called bronze age.

The small hill or mound from which some of the castings shown in the accompanying illustrations were taken, might be compared to a small island in a flat meadow. The ground in the vicinity is so wet that plans now are in hand to have it drained. At a former period when the shoreline was much higher than at present, this

Fig. 2—Remains of crucibles in which metal was melted

island must have been surrounded by shallow water or swamps. At that time it was separated by approximately 600 feet from the main land, which in this locality was a long ridge on which the road ran to the North.

Investigation up to the present seems to indicate that this mound or small island was the workshop and probably the dwelling of a foundryman who confined himself strictly to the production of bronze castings. Ash, stones, refuse and broken clay crucibles found around the base of the mound show that in some respects, conditions have not changed to any great extent in 3000 years. The ancient craftsman cleaned the rubbish out of his shop occasionally and probably congratulated himself on the fact that he did not have to hire a truck to haul it away.

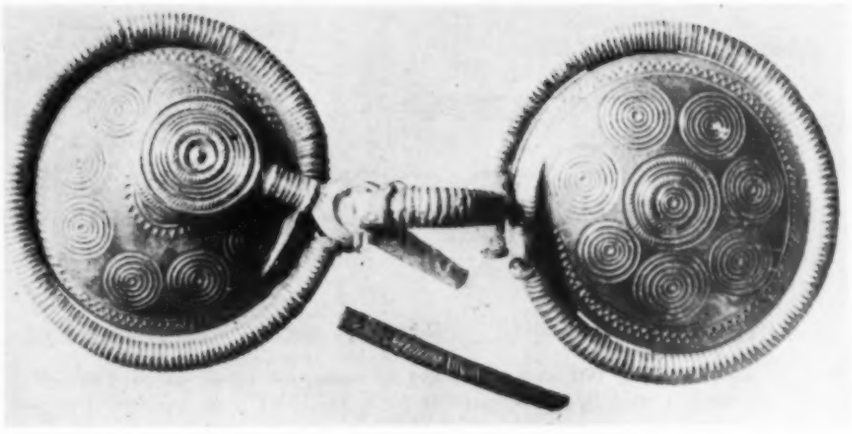


Fig. 4—Front view of the casting shown in Fig. 3

Specialized in Ornamental Pins

One, probably the last foundryman to inhabit the place, left pieces of a mold which indicate that he was highly skilled in the art as practiced at that period. The mold was intended for a thin wall pot and the surface was highly ornamented with a design of concentric circles.

However, his specialty appears to have been the long pins ornamented with large heads shown in Fig. 1. These pins were used for fastening the clothing at various points, thereby antedating buttons, hooks and eyes, snaps and all other devices developed at various periods for the same purpose.

By way of digression it is interesting to note that down to the present when a molder loses a suspender button, he instinctively inserts a nail—anything from 2 to 4 inches—in the gap by way of temporary repair. This practice opens an interesting field for speculation and debate. Is the act due to the jobbing molder's highly developed adaptability to meet emergencies, or, does it represent a faint stirring of brain cells that have lain dormant through generation after generation leading back to ancestors who lived in the bronze age and held their flapping garments in place with elaborate bronze skewers cast in a foundry.

Parts of the molds for half a dozen of these pins were found, but no castings were picked up. A remarkable feature about the molds is that they were made from a fine clay and apparently had been used only once. They are the first molds of the kind to be found in Sweden. Other ancient molds discovered at various times were carved from soapstone. Several cloth fasteners similar in design to the molds have been found in this section of the country and in all probability were produced in this prehistoric foundry.

Several pieces of crucibles also were found. A sufficient number of pieces were discovered to enable the finder to assemble them in the form of a complete crucible. A crucible of the same appearance is shown in Fig. 2. The capacity is small, only about ½-pound. It was made from a local clay of rather inferior quality as shown by the number of gas

(*Please turn to page* 54)

Fig. 3—View of defective ornamental castings worn over the breasts

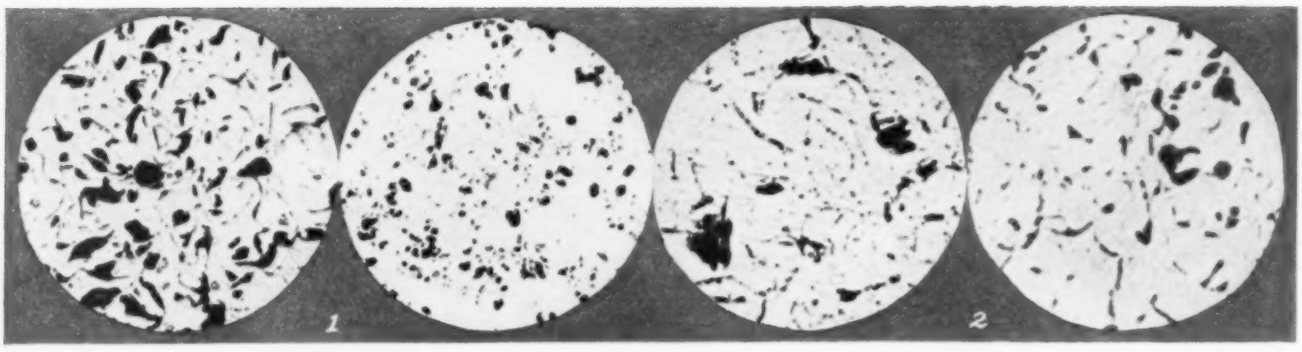


Fig. 1—Untreated at left, desulphurized at right, soft iron mixture 85 per cent scrap—100 diameters unetched. Fig. 2—Untreated at left, desulphurized at right, hard iron mixture, 100 per cent scrap—100 diameters, unetched

Desulphurizing with Fused Soda Ash

Process should not be hurried but ample time allowed for the refining reactions

By GEORGE S. EVANS

Mathieson Alkali Works, New York

DESULPHURIZING metal with fused soda ash, in early practice was limited to metal for heavy castings, where an appreciable loss in temperature was permissible. Improvements in ladle and forehearth equipment and in methods of carrying out the process have resulted in reducing temperature losses to a minimum and the practice gradually has extended into lighter and lighter casting fields. At present desulphurizing in either a teapot ladle or a forehearth is practiced regularly in the production of lawn mower, typewriter, sewing machine, radiation and other thin section castings. For both light and heavy castings, the use in the cupola charge of fused soda ash, known under the trade name of Purite, has expanded continually over the past 10 year period.

Like other foundry practices, any appraisal of the value of this development, necessarily must be based upon broad results over reasonably long periods. Every person familiar with foundry operations knows that from day to day or month to month it is impossible to duplicate exactly melting conditions, molding practice, composition and temperature of the metal, and other factors which influence the properties of the finished casting.

One or even several tests with soda ash, either in powdered or cake form, will not yield results sufficiently accurate on which to base sweeping conclusions. However, an average of results during 10 years of practical application of fused soda ash in the manufacture of almost every class and variety of castings, affords evidence of the commercial value of that material in ordinary foundry operation.

Although desulphurizing is not an exact science, the effect of soda slags on the properties of cast iron can be anticipated with about the same accuracy as ordinary composition adjustments of silicon or manganese effected by mixture changes. We know within practical operating limits just what may be expected with the use of 2 pounds, 10 pounds, or any amount used for treatment of the metal under varying conditions.

Extent of sulphur reduction that may be expected per pound of soda ash per ton of molten iron of varying sulphur content is shown in Table I. These results should be obtained with continuous treatment in a teapot ladle or forehearth under ordinary operating conditions. Percentage reduction per pound of reagent is fairly constant although naturally the actual re-

Table I

Reduction in Sulphur Varies

	Per cent			
Sulphur in iron from cupola	0.07	0.10	0.15	0.20
3 pounds reduces sulphur to	0.06	0.08	0.12	0.16
5 pounds reduces sulphur to	0.05	0.07	0.10	0.13
7 pounds reduces sulphur to	0.045	0.06	0.09	0.11
10 pounds reduces sulphur to	0.04	0.055	0.08	0.10

duction in points of sulphur will vary with the per cent of sulphur content in the iron before treatment.

Usually with good melting practice and proper equipment it is possible to reduce sulphur in cupola metal 25 or 35 per cent for light castings and 50 to 60 per cent in metal for heavy castings. However, it generally is impractical to go further without some means of superheating the metal either before or after the desulphurizing treatment.

Early Experimenters Expected Too Much

Unfortunately, many early experimenters misled by exaggerated claims, expected too much from the soda ash treatment and consequently were disapponited. In the early stages of development, one soda ash advocate circulated supposely scientific data purporting to show that the brinell or hardness number of cast iron decreased in almost exact proportion to the sulphur reduction. Such is seldom, if ever, the case in practical foundry operation, or even in laboratory experiments. Other claims have been made probably on the basis of specific results that could not be obtained regularly in every day practice.

Under different conditions the combined effect of the refining action of varying quantities of soda ash, coupled with changes in pouring temperatures incident to ladle treatment, may produce diametrically opposite effects upon the physical properties of cast iron. The brinell number and the tensile strength of cast iron from a given mixture may be increased or decreased by a variation in the treatment.

The sulphur may be reduced, the hardness increased and the machinability improved. For example in the treatment of a machine tool mixture carrying about 20 per cent steel and with a 0.12 per cent sulphur content the brinell number was raised slightly while the toolability, the comparative speed of machining, was improved through the addition of 5 pounds of fused soda ash to the ton of iron.

Similar treatment on an improperly melted low grade gray iron mixture showing approximately 1.50 per cent silicon with an abnormal combined carbon content of 0.80 to 0.90 per cent in 1-inch section, normally would reduce instead of increase the brinell number and thus result in even greater improvement in machinability. However, by gradually increasing the fused soda ash addition, a point will be reached where the brinell number starts upward. By going still further, machinability finally will be lowered even though the sulphur content shows a progressive reduction.

Table II

Properties of Limestone and Sodium Carbonate

	Limestone $CaCO_3$	Sodium Corbonate Na_2CO_3
Melting temperature	Over 4000 deg. Fahr.	1560 degrees Fahr.
Fuses or melts	In melting zone	Above meltg. zone
Fluxes with silica (sand)	2350 degrees Fahr.	950 degrees Fahr.
Slag fluid at	2600 degrees Fahr.	2000 degrees Fahr.
Fluxes or dissolves limestone at		1560 degrees Fahr.
Sulphur held by 30 per cent SiO slag	2.5 per cent	9.00 per cent
Reduces sulphur—average		1.5 points
Accelerates combustion at 1750 degrees Fahr.		10 fold (1)
Increases reducing action of carbon upon iron oxide (ore) at 1650 degrees Fahr.		8.8 times (2)

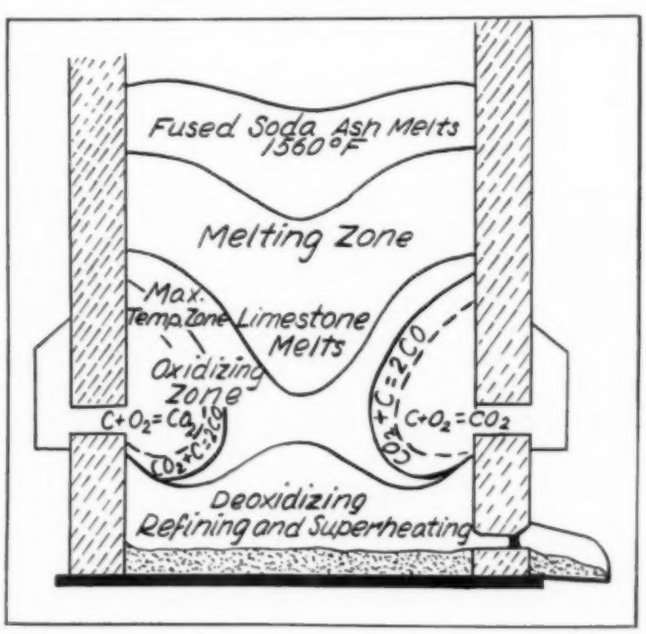


Fig. 3—Cross sectional view of cupola showing reactions when soda ash is used

Desulphurization Secondary Reaction

Contrary to the generally accepted idea, desulphurization actually occurs as a secondary reaction. The process exerts a softening effect upon the castings only to the extent that this tends to reduce the combined carbon. The first effect of the refining, and possibly, more important action, is to remove nonmetallic inclusions usually of an abrasive character. This action coupled with the refinement of graphite and elimination of hard spots due to more uniform graphitization throughout the section would seem to explain the improvement in machinability generally noticeable with the use of soda ash whether it is added in the ladle or as part of the cupola charge.

Although the ultimate result of refining, in addition to desulphurizing, is the removal of entrained slag and is deoxidizing in its effects, the initial reactions are both oxidizing and gasifying. This is indicated by the cycle of reactions shown in the accompanying presentation. These reactions probably do not follow the true chemical equation, but are offered rather as illustrating the resultant effect of (*Please turn to page* 62)

A. F. A. Program Goes International

Philadelphia convention, exhibition and congress will feature overseas papers

PAPERS of international character, prepared as exchange contributions of overseas foundry associations, will be one feature of the 1934 convention and exhibition of the American Foundrymen's association and the Fifth International Foundry congress, to be held in Philadelphia, Oct. 22 to 26. A report from Vincent Delport, European manager of THE FOUNDRY and a member of the international relations committee of the A. F. A. indicates that papers will be presented on behalf of the Institute of British Foundrymen, Foundry Technical Association of France, Foundry Technical Association of Belgium, Italian Foundry association. German Foundry association, Czechoslovakian Foundry association, and the Australian Bureau of Steel Manufacturers.

Dr. W. H. Hatfield, eminent British metallurgist, has been designated as the author of the I.B.F. paper. The Belgian paper will cover the subject of "Castability" and the Italian paper will deal with the manufacture of easily machined iron of high silicon content. Definite announcement as to the names of the authors and titles of the exchange papers will be made later.

Session To Feature Steel Castings

American papers will cover many of the technical and practical phases of foundry production and metal problems. The steel division sessions provide for one meeting devoted to four or five papers on the various factors of porosity and its elimination in steel castings. Papers for the second session will cover directional solidification and a comparison of test data on bars cut from separate cast coupons and from castings.

Three, and possibly four, sessions are to be scheduled for the cast iron division. The American Society for Testing Materials, through its committee A-1 on cast iron, and the A. F. A. committee on cast iron are forming a session on testing problems. Other sessions will have papers on permanent mold casting, use of forehearths, heat treatment, and fatigue limits of high strength alloy irons.

Malleable iron papers scheduled are on "Metallography of Annealing" and "Effect of Copper in Malleable." An important committee report will deal with the nomenclature of certain classes of special irons containing alloys.

The nonferrous division will have one of the most extensive programs of several years. The second symposium on deoxidation and degasification of nonferrous alloys will continue the review begun at last year's convention. Papers on other subjects will deal with porosity of leaded bronze bushings, effects of elevated temperatures on strength and dimensional stability of certain aluminum alloys, used in air-craft, and casting properties of nickel silvers and high nickel brasses.

Two papers are scheduled for the session on foundry equipment and materials handling. One will deal with maintenance of foundry equipment and the second with special problems in material handling. The refractories committee of the association expects to have two sessions on foundry refractories. Apprentice training, a subject of real interest in the face of a returning demand for foundry workers, sand control development and shop practice courses will complete the technical meetings.

The opening meeting on Tuesday will take on added significance this year, for it will include the address of welcome to the overseas guests and responses by representatives of the various countries represented. A prominent government official also is scheduled to address the members assembled at this meeting.

Grand ball room in the convention hall at Philadelphia, where many of the convention sessions will be held

Answer New NRA Queries

Durable goods study develops pertinent facts and shows the inability to increase burdens

MANUFACTURERS confronted by entirely new problems under the application of NIRA recently have become more active in presenting their viewpoint and in demonstrating to the administration their inability to meet some projected requirements. During the meeting of code authorities held in Washington early in March, a committee was selected to study conditions in the durable or capital goods industries. This committee which was selected and set up under chairmanship of George H. Houston, Baldwin Locomotive works, Philadelphia, is listed in the accompanying box. A notable representation of the foundry industry is found in its personnel.

Obviously, stagnation in the durable goods industry is a condition unaffected by many of the emergency measures put forward by Washington. While the pumping out of purchasing power through various emergency measures may have been effective in promoting manufacture and distribution of consumer goods, the demand for durable goods as represented by heavy machinery required in transportation and manufacture has been negligible.

Durable Goods Industries Committee

Chairman, George H. Houston, Baldwin Locomotive Works, Philadelphia.
C. R. Messinger, Oliver Farm Equipment Co., Chicago.
S. F. Voorhees, Voorhees, Guillin & Walker, New York.
James W. Hook, Geometric Tool Co., New Haven, Conn.
Robert W. Irwin, Robert W. Irwin Co., Grand Rapids, Mich.
George P. Torrence, Link-Belt Co., Chicago.
Franklin R. Hoadley, Farrel-Birmingham Co., Ansonia, Conn.
Lewis H. Brown, Johns-Manville Corp., New York.
C. C. Sheppard, Louisiana Central Lumber Co., Clarks, La.
H. Gerrish Smith, National Council of American Shipbuilders, New York.
Harry S. Kimball, Fabricated Metal Products Industry, Washington.
Walter J. Kohler, Kohler Co., Kohler, Wis.
F. A. Lorenz Jr., American Steel Foundries, Chicago.
J. S. Tritle, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Alvan Macauley, Packard Motor Co., Detroit.
Charles R. Hook, American Rolling Mill Co., Middletown, O.

With the establishment of the durable goods committee, the administration presented 12 points for discussion ranging from a consideration of effective price stabilization measures, the establishment of effective cost procedure and means to secure code compliance to specific requests such as that which was embodied in General Johnson's request that code hours be reduced 10 per cent and wages advanced 10 per cent, with the significant suggestion that if this procedure was not followed industry should set forth, "If not, why not?"

A report of the durable goods committee issued under date of April 30, deals with all of these questions. On the problem of price stabilization the committee feels that no uniform rule can be prescribed, approves the method of forbidding sales below costs, but points out the difficulty attending such a procedure in the sale of equipment which is built to special design and customer's specifications and therefore must be priced on estimates of costs prepared prior to actual production.

The open price system, having as an essential factor the publication of prices which shall not be altered by the maker until succeeded at a new effective date by a new price likewise published, is approved in this report. The significant statement "Secrecy is the principal menace to price stabilization" indicates the committee's viewpoint. It is pointed out that, with government representation on code authorities, adequate statistical reports, the right of appeal and the competition from outside the industry concerned, no extravagant and unreasonable price structure will result from such a system.

The committee strongly approves the administration of codes through code authorities and deprecates the multiplicity of outside agencies attempted or established which would take away from industry the right to self-government.

In the matter of the government's request for further reduction in hours and increase in wages, the committee reports that even under the disadvantages confronting durable goods manufacturers, the lowest paid workers in February 1934 were re- (*Please turn to page* 60)

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Speed Melting Process To Eliminate Dirty Castings

We are sending a bronze casting which is causing difficulty. These castings are melted in a coke fire natural draft pit furnace, and poured into No. 1½ Albany sand. We know that is not the proper sand for bronze but our sand was frozen so we used iron sand. The casting seems to be clean at the gate.

The casting is a typical example of bronze or brass that has been melted in an atmosphere in which there was insufficient oxygen. It is possible that your flues have been choked and therefore the draft has been reduced in your coke fire furnace, or that you are using a larger crucible than before thus reducing the amount of space around the crucible for fuel and the passage of air through the furnace.

The fracture indicates what is known as *soaked metal*, that is metal that has been exposed to underburnt gases for an extended period. If you can arrange the furnace so as to increase the speed of melting, either by increasing the amount of fresh air supplied to the flues so as to raise the temperature in the furnace by more rapid combustion of the fuel or by using a smaller crucible within the furnace so as to increase the flow of oxygen through the furnace, the difficulty should disappear.

As proof of this, it has been frequently shown that such metal as you indicated in the casting, after having been melted improperly, when cast into ingots and remelted in a furnace that melts the metal rapidly, with a minimum amount of soaking, is sound and good metal.

We do not believe that your use of iron sand had anything to do with the conditions; although it might be possible that the moisture content was sufficiently high to cause an excessive amount of steam to be formed and mixed with the metal. This is not indicated in the sample, as such a condition would develop blow holes rather than the dirty fracture now visible.

Phosphor Bronze Gear Is Gassed During Melting

We are submitting a section of casting of a 80-10-10 phosphor bronze worm gear. The metal used is supposed to answer to specification No. 64 of the S. A. E. We use strictly 80-10-10 ingot, new metal, and add two pounds of 15 per cent phosphor-copper to each 100 pounds of ingot about 2 or 3 minutes before pulling the pot. A crucible-type, oil-fired furnace is used and we pour these castings at 2000 degrees. They are molded in good open sand and gated in the middle as shown on drawing. Upon machining off the skin, we find the porosity in the heavy rim and our scrap loss is excessive. We shall appreciate your opinion on how to produce these castings satisfactorily.

This is a typical example of metal that has been gassed in melting. The furnace evidently is not consuming all the oil supplied to it; at least it is very improperly burned, thereby developing an atmosphere in the furnace that is saturated with unburnt gases. This slows up the melting practice and allows an extended time in which to dissolve these unburnt gases in the metal.

The only cure for this is to take the necessary steps to insure complete combustion by the presence of an ample supply of air (oxygen). See that an ample outlet for the gases is provided so that an excessive pressure of these gases on the surface of the metal will not prevail. This tends to increase the absorption of the unburnt gases where excessive pressures are present.

The fracture in your casting shows the effect of these gases upon the metal and the porosity of the casting is again the effect of these gases which are thrown out of solution as the metal solidifies.

The gating you indicate apparently is satisfactory but if you had metal that had been melted properly, it might have resulted in a casting

which was fed improperly since correctly melted 80-10-10 alloy does shrink some and, therefore, does require risers. You might have put risers where they can feed the heavy section. Since your metal has to enter this heavy section through a much lighter web in the center, no risers in the center would be able to feed the heavy section after the web had solidified.

Improper Melting Conditions Result in Porous Faucet Castings

We are forwarding two halves of ordinary lavatory faucets. You will note the porous condition which goes all the way through the castings, and is particularly noticable on the sides of the spouts. It has been our belief that such condition is caused by gas in the metal due to wet sand, hard ramming or over-hot metal, but others seem to think it is due to sand wash. The mixture contains approximately 79 per cent copper, 3 per cent tin, 6 per cent lead, and 12 per cent zinc, and is poured between 2000 and 2100 degrees Fahr.

While you have stated several of the causes which result in porous metal, you have left out one which, though extremely important, often is overlooked. It is true that your metal contains gas, but its source is not due to conditions you mention—rather it is caused by improper melting conditions, or it may be due to use of extremely oily chips in the charge. If it is your practice to include the latter in your charges, try mixtures without any chip additions, and observe the effect.

If porosity continues, then the melting conditions are such that a reducing atmosphere is present, and corrections will have to be made to obtain a neutral or slightly oxidizing atmosphere. That is not difficult to do with any type of furnace as it simply requires addition of more air so that complete combustion occurs with the fuel being used.

If the metal is being melted in an electric furnace, you may have to inject air in through a pipe if leaving the charging door open does not give the desired results.

Steel Additions To Charge Affect Quality of Gray Cast Iron

Our cupola charge includes steel scrap to the extent of 7.5 per cent from our sheet metal and press department. This scrap is not compressed but simply charged in bundles. We aim at a carbon content of 3.40 per cent and a silicon content of 2.30 per cent in the iron for our light castings. What effect will this steel addition have on the properties of the resultant metal, particularly on the porosity and machinability.

With your present method of charging the steel scrap, that is loosely in bundles, it is extremely doubtful if more than 50 per cent of the steel becomes molten to unite with the iron. The remaining 50 per cent is burned and just disappears. Instead of a 7.5 per cent steel addition, the actual amount probably does not exceed 4 per cent. This amount exerts very little influence on the physical properties or other characteristics of the metal in castings.

Steel additions to the cupola charge lower the total carbon and silicon content, therefore the resulting metal is closer and harder than metal of a similar analysis but containing no steel. The sheets from which you recover the scrap contain practically no silicon and the carbon is in the vicinity of 0.10 per cent. Molten steel automatically absorbs carbon from the coke in the cupola, but additional silicon must be provided, either in the shape of high silicon pig, or ferrosilicon to compensate for the absence of silicon in the steel scrap. Where the silicon and carbon and other elements are balanced properly and where the metal is melted under proper conditions, the presence of steel in the charge will not cause porosity and will not decrease the machinability.

Heat Bronze Casting Until Red Hot and Break with Sledge

Will you please give the best method of cutting or disposing of scrap aluminum bronze castings from 3 to 5 inches thick so that the pieces can be placed in No. 60 crucibles for remelting. The castings weigh from 350 to 700 pounds each.

We believe that if you will heat your aluminum bronze castings until they become red hot, and then use a sledge hammer on them, you will

Forehearth for 108-inch cupola at the plant of the United States Pipe & Foundry Co., Burlington, N. J.

find that they will break up easily. In heating give enough time to insure that the heat penetrates to the center of the casting.

Sash Weights Are Made in Variety of Ways

What is the best and cheapest method of making sash weight castings?

Sash weights are made according to a variety of methods, depending principally on the volume of business. In comparatively small quantities they are made extensively from solid patterns sunk half way in a follow board. The sand is rammed by hand. Where a squeeze or jolt molding machine is available, the patterns are mounted on match plates, one half the pattern on each side of the plate. Wood patterns are fairly satisfactory, but metal patterns are preferable for long and hard usage. In some plants the patterns are mounted vertically on jolt machines. The metal patterns are stripped through a suitable plate and the eye in each is formed by a small core. This method is confined to the shorter lengths. The length of the casting is determined by the distance the pattern is allowed to project above the plate.

In another method practiced extensively in large production shops, two rows of patterns (steel pipe) are rammed alternately above each other horizontally in a deep flask and are pulled out through openings in the end of the flask. The open ends are stopped by small cores or chills to form the eyes. The metal enters the terraced rows of molds through small gates at the opposite end. A comprehensive series of seven articles on the subject of sash weight molding appeared in THE FOUNDRY, March 15 to June 15, 1924.

Add Chromium To Grinder Plate Castings

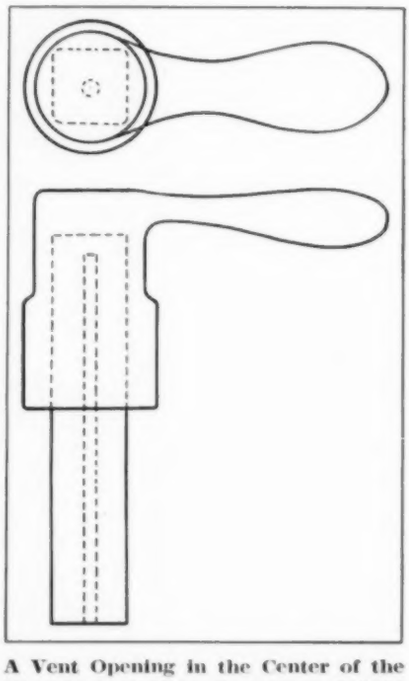
We are having trouble with warpage in the production of grinder plate castings. The charge for these castings is made up of our own return scrap mixed with malleable scrap. What is a suitable analysis for these castings approximately ½-inch in thickness? Would chromium ladle additions be advantageous?

Warpage of the castings may be due to design, method of gating, position in the mold, shakeout technique, or to a combination of two or more of these factors. Data submitted are not sufficient on which to base an opinion. To a slight extent your mixture of shop scrap and malleable scrap may be a contributory factor. Hard iron, or white iron shrinks and contracts more than gray iron. However, your problem is an individual problem and can be solved only by an expert foundryman familiar with all the conditions and free to try out changes in pattern design and molding methods. If the present castings meet the customers' requirements, you have no reason to change the mixture. Certainly you cannot make up any other for less cost. If cost is no object and if the customer insists on a stronger iron, the following analysis will be found satisfactory: Silicon 1.80 to 2.00 per cent; sulphur 0.10 to 0.14 per cent; phosphorus 0.20 to 0.30 per cent; manganese 0.60 to 0.90 per cent; total carbon 3.20 to 3.40 per cent; combined carbon 0.65 to 0.80 per cent. This metal is made up of steel scrap 30 per cent, return shop scrap 20 per cent, pig iron 50 per cent, and will show a tensile strength of 33,000 to 40,000 pounds per square inch and a brinell hardness of about 200. Addition of from 1 to 5 per cent ferrochromium to the metal at the cupola spout will produce a white iron casting showing a combined carbon content of 2.80 per cent.

Several White Metal Compositions Available

Will you kindly advise the proper mixture for a good hard white pattern metal composition of minimum amount of shrinkage?

There are a number of alloys used for making patterns, but the one most widely used is that containing 50 per cent zinc and 50 per cent tin. As you can see from its composition, the alloy may be used for making ounce metal if you desire when the patterns are outmoded. Another alloy that is used to some extent is composed of 80 per cent lead, 10 per cent tin and 10 per cent antimony. If it is not hard enough, decrease the lead content and increase the antimony content a like amount. A third alloy composed of 50 per cent lead, 40 per cent tin and 10 per cent antimony also is said to be satisfactory.



A Vent Opening in the Center of the Core Conducts the Gas Away Safetly

Core Needs Vent To Carry Gases Away

We are sending a small defective gray iron casting and one of the cores. You will note that the core has not moved, but the metal thickness above the core has disappeared. In some of these castings the hollow part over the core just shows through in a small opening. In others the defect extends almost from the back to the front with hardly any metal left.

The defect is what is known in the foundry as a *blow from the core*, which means that gas generated in the core by the heat of the molten metal, attempted to escape upward through the casting instead of through the core print. The trouble may be due to the core mixture, to part of the molding procedure, or merely to a slight oversight on the part of the coremaker. Examination of the core seems to indicate that the composition and degree of baking are satisfactory. Therefore we should say that a small horizontal vent hole in the center is all that is required to prevent a repetition of the present form of defect in the castings.

Method of placing the vent hole in the center of the core will depend on the present coremaking equipment. That is a detail that can be arranged by any coremaker. However, if a core vent wire is placed in such a manner that the vent appears at both ends, care must be taken to see that one end is closed before the core goes into the oven. Also care must be observed by the molder to see that the open end goes in the core print in the mold. If the castings are made in large numbers, the core print should be designed in a manner to prevent the possibility of placing the core in the mold end for end. Under ordinary conditions the gas from the core should escape through the core print and into the green sand of the mold. In some instances it is necessary to scratch a vent in the mold joint opposite the end of each core print to facilitate the escape of the gas. In some instances, also, this precaution is nullified by the application of a tight jacket to a snap flask mold. In cases of that kind the vent can be taken off by driving a vent wire through the cope over each core print.

Viewing Foundry Developments

At Short Range

PROPER cupola repair is an important factor in the production of uniform iron. Two cupolas operated exactly alike may produce iron differing widely in chemical analysis, due mainly to the fact the cupolas were not repaired to exactly the same dimensions. Numerous foundries have standardized cupola repair to the extent that all interiors must measure up to certain dimensions which are checked with templets.

♦ ♦ ♦

Aluminum castings to be arc welded should be prepared for welding by grinding, filing or scraping clean an area 1-inch wide completely surrounding the part to be welded. On large areas the casting should be heated just above the temperature at which the hand may be held on the metal without discomfort.

♦ ♦ ♦

ONE electric furnace operator recently installed a water cooled roof on the unit and found that the life of the refractory was increased and the power input decreased. Tests showed the amount of heat taken away by the water was less than that conducted through the roof in the unit not water cooled.

♦ ♦ ♦

To obtain increased toughness, ability to withstand deformation of shape without breaking, and to have malleable and nonmalleable portions in the same casting, is the subject of a recent patent. It pertains to such castings as manhole covers, etc., and employs a mixture containing 2.75 to 3.10 per cent carbon, 1.25 to 0.90 per cent silicon, 0.60 per cent phosphorus maximum, 0.20 per cent sulphur maximum, and 1 per cent manganese maximum. The metal is cast against a chill, and while still hot is transferred to a furnace maintained at 1650 to 1850 degrees and held for 15 minutes to 8 hours. Then it is cooled to 1350 degrees or slightly above and held for 1 hour. Quenching in a molten lead bath at 800 degrees for 4 minutes follows, and then the casting is heated to 1300 degrees and maintained at that temperature for 2 hours after which it is cooled.

♦ ♦ ♦

Manganese to a maximum of 0.35 per cent in malleable iron increases strength and yield point, but also increases the annealing time.

♦ ♦ ♦

NICKEL used occasionally in combination with molybdenum aids graphitization in malleable cast iron and increases strength and ductility. Chromium, formerly considered a deleterious element, now is used up to 1.25 per cent with an increase of silicon in making malleable fittings for the oil industry. Such castings have higher tensile strength, but marked lower elongation.

♦ ♦ ♦

In castings of irregular sections, a higher phosphorus content in the iron causes segregation near the junction of the light and heavy sections. In a test, a 6-inch block cast in dry sand with iron having a 0.1 per cent phosphorus content solidified in 43 minutes, while a similar block with a 1.5 per cent phosphorus content took 80 minutes to solidify.

♦ ♦ ♦

The Cleveland Electric Illuminating Co., Cleveland, has equipped and is operating a new lighting demonstration car for use in demonstrating industrial and commercial lighting. A part of the equipment permits measuring light intensities in any part of the establishment, or placing fixtures at any point between the floor or ceiling to locate the exact point of maximum efficiency.

♦ ♦ ♦

To provide an accurate check on the accuracy of the optical pyrometer, one large plant in the automotive industry has three instruments. One pyrometer is in daily use, the second is held in reserve in case something happens to the one in service and the third is kept in the laboratory and used only to check the service instrument weekly or oftener. In this way the management knows that 2800 degree Fahr. iron this year has the same heat as 2800 degree iron next year.

♦ ♦ ♦

TITANIUM additions have been made to malleable iron to remove sulphur and reduce oxygen. It is said to have a slight effect in raising physical values.

♦ ♦ ♦

Thickness of the cupola lining is an important factor in influencing refactory costs. A heavy lining acts as an insulator, raising the mean temperature of the lining and causing greater damage. A maximum thickness of 9 inches has been recommended for the cupola lining.

♦ ♦ ♦

IN A RECENT proprietary process developed for decreasing or eliminating the chill effect in centrifugally casting iron pipe in iron molds,

a thin coating of powdered metallic or nonmetallic substance is applied to the mold surface 6 seconds before the molten metal is permitted to strike it. Control of the coating thickness is important, and the following limits are mentioned: Ferrosilicon (30 mesh), 0.0003-inch; kaolin, 0.0009-inch; talc, 0.0009-inch; magnesite, 0.0005-inch; ferromanganese, 0.0007-inch; mica, 0.0008-inch; zirconium-manganese-silicon, 0.0008-inch, and seacoal, 0.001-inch. The coating is applied by mixing with compressed air forcing it through a nozzle situated just back of the pouring spout.

The FOUNDRY Family Photograph Album

Upper Left
Dr. F. R. Henry
Simonds, Worden
White Co.,
Dayton, O.

Upper Right
G. W. Sanborn
United Engineering
& Foundry Co.
Pittsburgh

Lower Left
Alexander Sellers
William Sellers
& Co.,
Philadelphia

Lower Right
R. E. W. Harrison
Department of
Commerce
Washington

Men of Industry

Whose Activities Are Making Foundry History

HARRY RAYNER, recently elected president of the Detroit Foundrymen's association, is foundry metallurgist, Dodge Brothers Inc., Detroit. Mr. Rayner was born in Canada and was educated in the public schools of Hamilton, Ont., and in the Hamilton Collegiate institute of that city. From 1906 to 1918 he was employed in the Hamilton plant of the International Harvester Co. of Canada Ltd., and for the greater part of that period was chief chemist in control of the raw material inspection department and metallurgical work in the gray and malleable iron foundries. From 1918 to 1920 he was employed as chief chemist at the plant of the Advance-Rumely Co., La Porte, Ind., and in 1920 he became connected with Dodge Brothers. Mr. Rayner has been active in the Detroit association for a number of years, and has presented several technical papers before that group and the American Foundrymen's association.

L. F. C. GIRARDET, recently elected president of the Association Technique de Fonderie of Paris, started his career as a professor of chemistry at the faculty of pharmacy in Nancy. While at that post he published a number of works on pure chemistry, electrochemistry and physical-chemistry. After the war he relinquished his professorship, but continued to publish important works on biological chemistry in collaboration with Prof. Lasseur.

In 1925 he took over the control of a foundry at Saint Die, where he introduced scientific methods. He studied particularly cast iron from the point of view of the relation between its structure and its mechanical properties and developed methods of control in the manufacture of castings. In recent years in collaboration with Mr. Tsou, he has studied the problem of corrosion in cast iron and has also dealt with the desulphuration of cast iron with Mr. Lelievre. At present he is investigating the physico-chemical study of molding sands, and recently has published two important papers on the subject.

Mr. Girardet has received the gold medal and several silver and bronze medals from the university. In 1932 he was awarded the first silver medal of the Association Technique de Fonderie. One of his most important contributions was his investigation on the effect of stirring liquid

L. F. C. Girardet

cast iron, with the view of modifying the structure of castings. Following these investigations he developed a special method for stirring molten iron in a rotating foreheath.

ROBERT E. W. HARRISON, Cincinnati, (see foundry album on opposite page) has been made chief of the industrial machinery division of the bureau of foreign and domestic commerce, succeeding W. H. Rastall, who recently resigned to accept an executive position with the capital goods section, division of research and planning of the National Recovery Administration.

Mr. Harrison has had an extremely active professional career during which the study of economic trends in engineering development has been his chief interest After an extended experience in foreign markets, he assumed the position of mechanical engineer of the Cincinnati Milling Machine Co., Cincinnati, in 1926. On incorporation of Cincinnati Grinders, a subsidiary, he was appointed director and chief engineer, and later when sales and engineering activities of the companies were merged, he was appointed sales engineering director for both. In 1932 he established a consulting engineering practice specializing in problems of design, management and marketing. He is chairman of the committee for standardization of tolerances and allowances for the cylindrical parts and limit gages, organized by the American Standards association. He is also secretary of the executive committee of the machine shop practice division, American Society of Mechanical Engineers.

ALEXANDER SELLERS, (see foundry album on opposite pages), recently elected president of the National Metal Trades association, has long been prominent in the metal working field. Affiliated since 1895 with the industry and with the company he now heads, William Sellers & Co. Inc., Philadelphia, he has been active in various phases of metal working, particularly in the development of machine tool equipment. He was graduated from the University of Pennsylvania in mechanical engineering in 1895, and directly became associated with the Sellers company, which was founded by his father, William Sellers. He served first as an aprentice, worked his way through the shops as foreman and superintendent, was elected vice president in 1905 and president in 1926.

PROF. MELVIN L. ENGER, a member of the faculty of the University of Illinois, Urbana, Ill., since 1907, and head of the department of theoretical and applied mechanics since 1926, recently was named dean of the college of engineering and director of the engineering experiment station of the university. Prof. Enger was born in Decorah, Iowa, in 1881, studied at the University of Minnesota and finished his undergraduate work at the University of Illinois, being graduated with the degree of

bachelor of science in civil engineering in 1906. He received the professional degree of civil engineer in 1911 and the degree of master of science in 1916. Following his graduation he spent 1 year with the Chicago, Milwaukee, and St. Paul Railroad, and then returned to the University.

R. G. SWEENEY, purchasing agent, Allyne-Ryan Foundry Co., Cleveland, recently was re-elected president of the Purchasing Agents of Cleveland.

FRANK WHEATLEY, president, Wheatley Bros. Foundry & Machine Works, operating plants in Tulsa, Okla., and Kansas City, Mo., has moved his headquarters to Tulsa, to take active charge of the company.

THEODORE AHRENS recently resigned as president of the American Radiator-Standard Sanitary Corp. because of ill health. He will continue as a director and member of the executive committee.

A. C. RICHARDSON, formerly connected with the bureau of mines at the southern experiment station in Tuscaloosa, Ala., has been appointed to the technical staff of Battelle Memorial institute Columbus, O.

CHESTER R. AUSTIN, formerly associated with the Roseville experiment station of Ohio State university, Columbus, and later compressor engineer with the Ohio Fuel Gas Co., Cambridge, O., also has been appointed to the institute's technical staff. He will be active on a special refractory project.

ARTHUR AIGELTINGER has been elected vice president of the American Brake Shoe & Foundry Co. and KEMPTON DUNN has been elected assistant treasurer. Both have been associated with the company for a number of years. Other officers were re-elected.

CARL L. LIEBAU for 13 years vice president and general manager of the Decatur Malleable Iron Co., Decatur, Ill., has become associated with the sales department of the Federal Malleable Co., West Allis, Wis. Mr. Liebau previously was general manager of the Vermillion Malleable Iron Co., Hoopston, Ill.

CARL H. ANDERSON has been elected president and general manager of the Rich Mfg. Co. Ltd., Los Angeles, which recently took over assets of the United States Foundry Ltd. and the Fernholtz Machinery Co., also of Los Angeles. Other officers of the Rich company include: Vice president, L. W. KIRKPATRICK; secretary and treasurer, A. C. DELEVANTI; and sales manager, EDWARD F. ALT.

EDGAR N. DOLLIN, formerly president, Allied Die Casting Corp. and Acme Die Casting Corp., has been appointed manager of the die casting division of the American Type founders, Jersey City, N. J. He is also general manager of the Precision Die Casting Co. and is well known in the industry in which he has been connected actively since 1912. Under his direction the die casting of the American company division will be expanded to produce various forms of commercial die castings.

E. O. Goss recently was elected president and general manager of Scovill Mfg. Co., Waterbury, Conn. Other officers are as follows: vice president and general superintendent, JOHN H. GOSS; vice president, C. P. GOSS JR., GEORGE A. GOSS, WILLIAM M. GOSS and BENNET BRONSON; treasurer and controller, LEAVENWORTH P. SPERRY; secretary and general counsel, FRANCIS T. REEVES; assistant seiretary, BURTON P. HYDE; assistant treasurer and controller, J. V. MONTAGUE; assistant secretaries, T. B. MYERS, W. W. BOWERS and C. F. DOHERTY.

B. H. NEWELL has been made general superintendent, gray iron foundry of the Buick Motor Co., Flint, Mich. Mr. Newell has been identified with the automobile industry for a considerable period. For 10 years he had been superintendent of the foundry of Dodge Brothers Corp. Later he served for 3 years as foundry superintendent for the Oakland Motor Car Co. During the last 15 months he has been assistant to the foundry manager of the Cadillac Motor Car Co. Mr. Newell is a graduate of Ohio State university, Columbus, O.

G. WALTER SANBORN (see foundry album on page 34) was elected vice president of the United Engineering & Foundry Co., Pittsburgh in charge of purchases and traffic after the company's annual meeting recently. He had been purchasing agent since 1921. He began his business career with the William Tod Co., Youngstown, O., in 1902 where he was employed in the machine shop. Later he held the positions of storekeeper, receiving clerk and shipping clerk until in 1909 he was made purchasing agent for that company.

In 1912 Mr. Sanborn went with the Wheeling Mold & Foundry Co., Wheeling, W. Va., as field inspector and expeditor but shortly thereafter returned to the William Tod Co. and was with them when they were taken over by United Engineering & Foundry Co. in 1917. At that time he was transferred to Pittsburgh and made assistant purchasing agent for the company. Four years later, in 1921, he was given the appointment of purchasing agent for the United Engineering & Foundry Co.

THOMAS E. LAMONDY has been appointed superintendent of the foundry and the metal and wood patternshop of the Adams & Westlake Co., Elkhart, Ind. Mr. LaMondy was connected with that company some 20 years ago, and resigned in 1914 to go to Canada to assist in ordnance production. He returned to the United States three years later and since has held a number of important positions as foundry superintendent for such firms as the American Crucible Products Co., Lorain, O.; Mueller Brass Co., Port Huron, Mich.; General Aluminum & Bronze Co., Detroit; Johnson Bronze Co., New Castle, Pa.; and the Amalgamated Metals Co., Chicago.

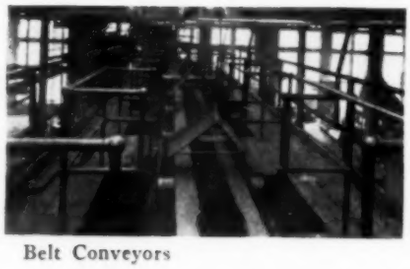
HIS MAJESTY KING GEORGE V has accepted the Bessemer gold medal of the council of the (British) Iron and Steel institute. The King has been the patron of the Iron and Steel institute since his succession. The Bessemer gold medal was founded in 1873 by the late Sir Henry Bessemer, discoverer of the Bessemer process of steelmaking and the second president of the Iron and Steel institute. He has been awarded annually since that date to distinguished benefactors of the industry and particularly for preeminent contributions toward the scientific and technical knowledge of iron and steel. In 1899 Queen Victoria, and in 1906, King Edward VII received the medal.

A. L. CLARK, formerly vice president, American Brake Shoe & Foundry Co. of California, recently was elected president succeeding the late Thomas Finigan. Mr. Clark has been connected with the foundry industry since 1902 when he was employed as chief clerk of the American Brake Shoe & Foundry Co., at its Mahawk, N. J. plant. He entered the operating department in 1905 as assistant to the general superintendent, 4 years later was made superintendent of the Norwood, Mass. plant and in 1912 he assumed a simiar position at the Chicago works. A year later he was made superintendent of the western foundries and during the war period was acting works manager. In 1921 he was made general manager of the California subsidiary and vice president in 1922.

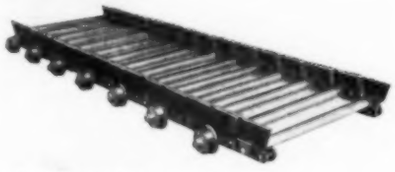
Pendant Type Mold Conveyors

Floor Type Mold Conveyors

Recent Jeffrey Installations Prove "It Pays To Modernize"



Belt Conveyors



Leak-Proof Apron Conveyors

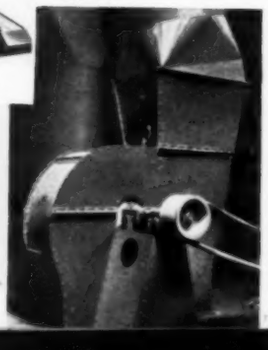
Foundry Type Valves

Sand Mixers

Aerators

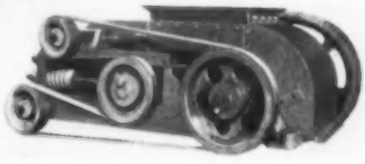
Portable Conveyors

Pulverizers



Fans

Scraper Conveyors



Disintegrators

Flask Fillers

Screens

Flask Fillers

Jeffrey points with pride to its many recent Foundry installations which are proving highly successful.

Those Foundries that have modernized are learning that Jeffrey Equipment will easily meet their most severe requirements . . . will greatly reduce their operating costs. The Jeffrey line of handling and sand conditioning equipment for foundries . . . both large and small . . . complete systems or small installations . . . is complete. The list includes:

Conveyors: Apron, Belt, Scraper Flight, Flask, Mold, Castings, Trolley
Flask Fillers Bucket Elevators
Core Crushing and Reclaiming Equipment
Sand Reclaiming and Conditioning Equipment
Portable Loaders Crushers and Pulverizers
Chains, Wheels and Buckets Bins and Hoppers
Transmission Equipment Screens, Rotary and Electric Vibrating
Flask Knock-out Units Fans Mixers
Aerators Bottom Dump Buckets

Jeffrey Foundry Engineers will help you in the modernization of your foundry operations for greater operating economy. Write them today.

Mail This Coupon—and get a copy of Catalog No. 540 in which you'll find the complete Jeffrey Service for the Foundry described and illustrated. Typical arrangements of equipment are clearly pictured by perspective drawings. Clip and mail this coupon.

The Jeffrey Manufacturing Company, 907-99 North Fourth St., Columbus, Ohio
Please send copy of Jeffrey Foundry Catalog No. 540

Firm Name .....

Individual .....

Address .....

We are interested in .....

Michigan State Holds Short Course

Foundrymen discuss problems relating to the melting of iron at three day session

TECHNICAL and practical problems relating to the melting of iron featured the second annual short course in foundry work conducted by the mechanical engineering department of Michigan State College of Agriculture and Applied Science at East Lansing, Mich., April 19 to 21, in co-operation with the Detroit Foundrymen's association. Details for the meeting were prepared under the direction of Prof. Frederick G. Sefing of Michigan State college. Meetings were held in the R. E. Olds hall of engineering, and during the meeting the visiting foundrymen inspected the university foundry and witnessed the first heat from a new indirect arc, tilting type electric furnace just installed as equipment for a research program to be undertaken shortly.

At the opening session on Thursday morning, Frank G. Steinebach, managing editor of THE FOUNDRY, Cleveland, spoke on "The Development of Melting Cast Iron," tracing briefly the early history of the foundry industry and outlining some of the more important developments in the art of melting which have had considerable influence over the design of present day melting equipment.

Variables of Construction

Three papers were presented at the Thursday afternoon session under the chairmanship of Jesse D. Stoddard, Detroit Testing Laboratory, Detroit. John Grennan, University of Michigan, Ann Arbor, Mich., in a paper on "Cupola Design," discussed the variables of construction which influence operation. He pointed out that no research has been completed to establish definitely the height of the charging door. He stated that the single row of tuyeres probably is the most popular and also indicated the features of tuyere design in the balanced blast cupola developed in England. In discussing the height of the bed, results of experiments at the University of Michigan were presented, in which it was shown that using the same melting ratio and with the same tuyere height and area hottest iron was secured with a bed of 66 inches. In this test, the bed rather than the height of the charging door seemed to have the greatest influence on the temperature of the iron.

R. E. Aptekar, consulting engineer, Ypsilanti, Mich., in a paper on "refractories," described the various zones in the cupola and discussed the properties required by the refractories in each zone. He stated that physical rather than chemical properties are of most importance in many instances, and discussed the composition diagram of alumina and silica to show the most desirable composition for cupola use. In the discussion, Robert E. Kennedy, technical secretary, American Foundrymen's association, Chicago, pointed to the work which has been done by the committee on refractories of that association.

Sand in the Cupola

A paper on "Slags," read by Fred J. Walls, Eaton-Erb Foundry Co., Vassar, Mich., stated that in making a cupola charge it is important to create a slag which has as low a fusion point as is consistent with conditions present, and at the same time is in a sufficiently large quantity for cupola operation control, to cover well the bath of molten iron in the hearth and to act as a secondary cleanser for the molten iron passing through it. When the cupola bridges, the author suggested throwing sharp sand into the furnace.

H. V. Crawford, General Electric Co., Schenectady, N. Y., presented a paper on "The Air and Gases in the Cupola" at the Friday morning session, with Henry Lane as chairman. Mr. Crawford stressed the importance of air as a material in cupola operation and stated that after the cupola has been charged, air is the only controllable variable which will affect the iron materially. Through the aid of charts he showed the theory of combustion within the cupola, the changes which occur in cupola gases, and the different reactions which take place in the various zones of the furnace. He also presented a simple method for determining the proper weight of air to secure correct control for existing conditions in cupola melting.

The afternoon session, with Harry Rayner, Dodge Bros. Inc., Detroit, as chairman, took the form of a round table discussion under the leadership of Fred J. Walls. In discussing linings for cupolas in continuous operation, Mr. Walls stated that he did not consider it advisable to patch over partly burned brick but believed it necessary that such bricks be replaced. It was suggested that in figuring the heat produced in the cupola, consideration should be give to the heat secured through the oxidation of silicon and manganese in the iron. Considerable discussion centered around materials for the slag and tap holes, with a number of those present favoring purchased blocks.

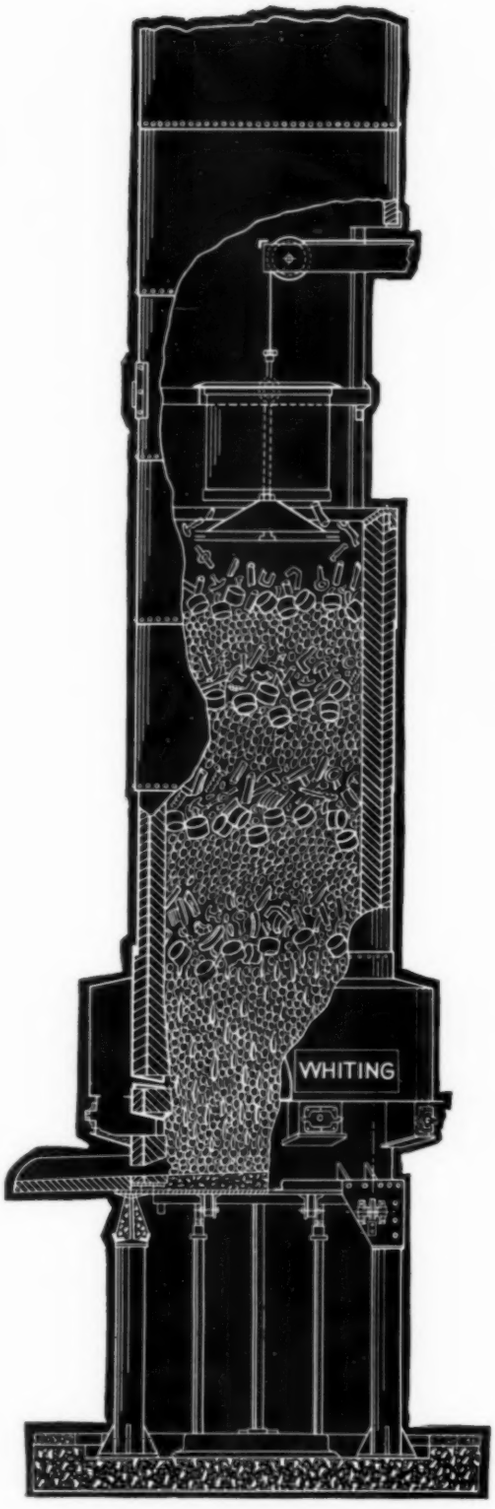
It was stated that bundled scrap which is being used by many foundries in the Detroit district, probably should be made up in bundles probably not exceeding 100 pounds to secure the best results in the cupola. Ordinary molding sand which is fairly open was favored by many for the cupola bottom, and it was pointed out that a tight sand causes the metal to boil.

Method Is Flexible

Charles Morrison, assistant metallurgist Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich., presented a paper on "Electric Furnace and Duplexing" at the Friday evening session, at which Glenn Coley, metallurgist, Detroit Edison Co., Detroit, presided. Mr. Morrison discussed the operation of the cupola in melting the iron and the use of the electric furnace in superheating. He stated that over a period of years, the duplexing method in the production of malleable cast iron has proved superior to previous methods employed at his plant, since it is more flexible, produces more uniform iron, adapts itself well to straight line production and has a low overall cost.

A paper on "Special Cast Iron Alloys," presented by R. G. McElwee, general manager, D. J. Ryan Foundry Co., Ecorse, Mich., described the practice employed in

(*Concluded on page 40*)



Electromet Ferro-Alloys now available in briquet form include E. M. SILICON BRIQUETS (round) E. M. CHROMIUM BRIQUETS (hexagonal) E.M. MANGANESE BRIQUETS (square)

SEE THE UCC EXHIBITS
A CENTURY OF PROGRESS
CHICAGO
1934
HALL OF SCIENCE

E. M. BRIQUETS put your Alloys where they do the most good

★ Every ounce of alloy added to your cupola in the form of E. M. Briquets reaches the melting zone before it is liberated. This is due to the protection of a refractory binder which does not allow the briquet to disintegrate while passing through the upper oxidizing regions. In the melting zone the binder passes off to the slag, the alloy goes into thorough solution with the iron, and a uniform product of required specifications is the result.

E. M. Briquets contain exact amounts of the alloy. When it is time to make the alloy addition the necessary number of E. M. Briquets are counted out and thrown into the cupola. The element of guess is eliminated. You know that the alloy is added in sufficient quantities and there is no waste.

Electromet engineers will be glad to help you realize every possible advantage from your use of E. M. Briquets. When requesting further information, outline your current problems and let their experience work for you.

PRODUCT OF A UNIT OF
UCC
UNION CARBIDE AND CARBON CORPORATION

Electromet
Ferro-Alloys & Metals

ELECTRO METALLURGICAL SALES CORP.
Unit of Union Carbide and Carbon Corporation
UCC
CARBIDE and CARBON BUILDING 30 E. 42nd STREET, NEW YORK, N.Y.

(*Concluded from page* 38)

producing several different types of alloyed cast irons, including a modified malleable. The latter has an approximate composition of total carbon 2.40 per cent; silicon 1.30 to 1.60 per cent, depending on the sections; manganese 0.35 per cent; and sulphur and phosphorus as low as possible. A number of heat treatments may be used, the following being typical: Heat at 1750 for 4 hours, cool in furnace to 1550, oil quench, and draw 1 to 10 hours at 1300 degrees. One hour draw at that temperature will produce the following physical properties: Tensile strength 90,000 to 100,000 pounds per square inch; elastic limit 65,000 to 75,000 pounds per square inch; elongation 2 to 3 per cent; and brinell hardness approximately 255.

Saturday morning, Carl Joseph, metallurgist, Saginaw Malleable Iron division, General Motors Corp., Saginaw, presented an interesting paper on "Cupola Control," in which he discussed in general the factors which must be taken into consideration in securing complete control of melting operations, and presented detailed information on the practices followed at his plant. Mr. Joseph believes that the proper selection of raw materials is one of the most important factors in cupola control, and presented data sheets to show the practice data which is secured from both the blast furnaces and the coke ovens.

Harry W. Dietert, chief engineer, U. S. Radiator Corp., Detroit, in a paper "What the Future Holds for the Cast Iron Industry," predicted that the industry today is securing an ever broadening field for its products. Recent developments, including the production of exceptionally high strength irons, an increase in corrosion resisting properties, the development of irons to meet high temperatures, the collection and dissemination of technical data on gray iron, the application of modern merchandising methods and the introduction of one part casting construction, have set the stage for remarkable progress.

The Detroit Foundrymen's association held its regular monthly meeting in the Michigan State Union building on Thursday night of the foundry course, with Fred J. Walls, president of the group, presiding. Speakers included H. B. Dirks, dean of engineering, Michigan State college, who welcomed the foundrymen to the campus, and Rev. W. S. Carpenter of Lansing, who spoke on "Fundamentals of Prosperity."

The following officers of the association were elected for the coming year: President, Harry Rayner, Dodge Bros; vice president, Vaughn Reid, City Pattern Works; secretary, Harry J. Deutsch, Aluminum Co. of America; treasurer, Frank X. Mushynski, American Car & Foundry Co.; members of the executive board, Ira F. Cheney, Griffin Wheel Co., and Fred J. Walls; A. F. A. representative, Jesse D. Stoddard, Detroit Testing Laboratory. James L. Mahon announced that the annual banquet and ladies night program would be held May 17.

Information on the set-up and organization of district sections of the American Foundrymen's association was presented by Robert E. Kennedy, and the executive committee of the Detroit association will report regarding affiliation with the national association at the next meeting.

Ohio Foundrymen Discuss Technical Problems at Columbus Meeting

THE technical department of the American Foundrymen's association through the co-operation of the industrial engineering department of Ohio State university and a local committee staged a two day foundry conference in Columbus, April 5 and 6. John Younger and R. P. Schneider of the industrial engineering department presided at the opening session where the welcome of the university was extended. R. E. Kennedy, technical secretary, A. F. A. outlined the work and accomplishments of the association in educating producers and users of castings.

Dr. D. J. Demorest, department of metallurgy of the university compared the heat value of various fuels including coal, oil, gas, butane and electricity ranging at present prices from 15½ cents for coal to $3.66 for electricity per million B.t.u. C. Smith, Bonney-Floyd Co., Columbus, detailed the heat treatment practice followed by his firm. Both carbon and alloy grades are given quenching and tempering treatment. He gave as an example carbon steel wheel centers for electric locomotives developing the following specification properties: Tensile strength, 85,000 pounds per square inch; yield point, 55,000 pounds per square inch; elongation, 22 per cent in 2 inches; reduction in area 40 per cent. These wheel centers were tested by drop test with a 30 pound weight dropped three times through a 20 foot distance on the center of the wheel supported at the rim this test was met without any sign of crack or failure. Mr. Smith defined as the essential factors in good heat treating practice, quick handling, adequate capacity, and close control with proper pyrometric equipment. The wheel centers were quenched from 1600 degrees in water and tempered at 500 to 1300 degrees Fahr.

Dr. John W. Bolton, Lunkenheimer Co., Cincinnati, outlined the development of gray cast iron within the past 15 years. The importance of total carbon and graphite state, new thoughts to the gray iron foundrymen 10 years ago, are vitally important today. Dr. Bolton prophesied the possibility of obtaining graphite in nodular form as the next long step in the advance of gray cast iron.

G. A. Bole, engineering experiment station, Ohio State university, described new developments in insular refractories at the Friday morning session. This was followed by a short round table discussion on the preparation of molding sand.

Prof. W. J. McCaughey, department of mineralogy, described investigational work which has been proceeding for a number of years on the influence of slag in blast furnace and open-hearth steel practice. Dr. McCaughey holds that removing fusable compounds emisive to the metals is the primary function of slag in all melting processes. Studies are being made to determine what mineral compounds are most effective in accomplishing this purpose.

Dr. C. H. Lorig, Battelle Memorial institute, described new developments in the production of malleable cast iron. The definite advances which have been made in shortening annealing time and in imparting new properties by the addition of alloys were described.

At the dinner meeting Thursday Dr. H. W. Gillett, Battelle Memorial institute spoke on the future of the foundry industry and Dan M. Avey, vice president American Foundrymen't association, on merchandising castings.

The local committee in charge of the program was as follows: Chairman, A. W. Gregg, Bonney-Floyd Co.; E. W. Campion, Buckeye Steel Casting Co.; J. M. Kittle, Ohio Malleable Iron Co.; H. W. DeBruin, Jeffrey Mfg. Co.; W. C. McMahon, Columbus Malleable Iron Co.; L. H. Marshall, L. H. Marshall Co.; C. H. Lorig, Battelle Memorial institute; R. P. Schneider, Industrial Engineering department; Secretary, A. H. Dierker, Engineering Experiment station, Ohio State university.

Falcon Bronze Co., Youngstown, O., is sponsoring a research program at the Battelle Memorial institute, Columbus, O., to improve the quality of copper alloy castings. The project will be in charge of C. H. Lorig.

ADVERTISING PAGES OMITTED

Prevent Losses with

Proper Gates and Risers

BY PAT DWYER

WHEN pouring small side floor or snap flask castings from shank ladles, usually it is necessary to transfer the metal from the ladle to the mold in the shortest possible time and at the highest practical temperature. Where this precaution is neglected the metal may not flow the full distance nor completely fill the entire mold cavity. A few seconds variation in the pouring speed of certain small castings may represent the difference between success and failure.

High temperature of the metal is not detrimental for light, thin sections. The steel solidifies so rapidly that it does not burn the sand to any extent and does not set up the difficult cleaning problem found in large castings poured with exceedingly hot metal. If the area is not too great and if the casting is gated properly, the high temperature will not cause the metal to crack.

Many large castings should be poured with comparatively cold metal and as slowly as the temperature will permit with safety to fully and completely take the impression of the mold. When poured cold and slowly the metal will not burn into the sand to the same extent as metal poured fast and hot. Also there is less probability for the casting to develop checks and cracks.

Various Types of Ladles

Ingot makers are familiar with the appearance of cracks which follow when metal is poured too hot. Cracked castings in many instances may be traced to the same cause. In a typical example cast steel cylinders 6 inches inside diameter, 10 inches outside diameter and 5 feet in length have developed extensive cracks when poured fast with hot metal in the first part of the heat. The same cylinders showed no sign of cracks when poured slowly at the end of the heat with cooler metal.

Since the various types and sizes of ladles employed in steel foundries constitute an important contributory factor in the process of transferring the molten steel to the molds it is quite pertinent at this point to refer to the subject briefly as summarized by R. B. Farquhar Jr.

Control the Speed

LADLES through which the steel flows from a nozzle in the bottom are used exclusively in open-hearth plants and to a considerable extent in steel foundries where the metal is tapped from converters and electric furnaces, particularly where steel is prepared according to the basic process. The blanket of slag keeps the metal hot over a comparatively long period. Any entrained slag floats toward the top and away from the nozzle from which the clean metal enters the mold. The speed of pouring may be regulated by intelligent manipulation of the stopper. On account of the higher temperature attained in acid lined converters and electric furnaces, the metal readily is handled in teapot type ladles and poured over the lip. Small castings are poured from hand shank ladles filled from the larger ladles mounted on trucks or suspended from the crane.

Bottom pour ladles are used almost universally where large volumes of metal are handled, although many small ladles of that type are employed for handling heats as small as 3 tons. The bottom pouring method prevails in large open-hearth plants whether the furnaces are basic or acid lined. Bottom poured ladles are used almost exclusively for pouring basic metal from electric furnaces even though the heat may not exceed 2 or 3 tons. This practice prevails due to the difficulty in skimming thoroughly the powdery carbide slag from lip, teapot or bull ladles. Among the advantages of bottom pouring it may be mentioned that the coating of slag which covers the metal acts as a protection from drafts and hasty chilling.

Where the stream is drawn from the bottom of the ladle through a nozzle, the entrained slag permeating the bath of metal just tapped constantly rises toward the surface and away from the exit. Thus the metal will remain hot over a longer period and the tendency for slag to be drawn into the mold is reduced. Particles of slag which rise to the surface after lip pour ladles are skimmed, are not nearly so prevalent in the castings, but this method presents difficulties.

Common troubles with nozzles and stoppers cutting out, leaking or breaking, often are cited as serious disadvantages in the bottom pouring method. These troubles are real, but generally they can be prevented by careful study, by experience, and by close attention to detail. In a typical instance one foundry superintendent personally investigated every leaky or other stopper trouble. In this manner he arrived at a correct diagnosis, or perhaps more properly speaking an accurate post mortem decision and spared no expense to prevent further trouble of a like character.

Cost Is Considered

As compared with over the lip pouring, the additional cost of stoppers, nozzles, stopper rods and sleeves must be considered in connection with bottom pouring. Usually also, the degree of skill and the amount of labor is greater in preparing the bottom pour ladle and also in the actual teeming of the metal.

In a shop handling a great deal of side floor work where most of the metal must be poured from shank ladles, the metal may be transferred with about equal facility from the crane ladle of either the lip or bottom pour type. Considerable study and an extended series of tests in one foundry seemed to indicate that bottom pouring into shank ladles from a bottom pour ladle presented many advantages to offset stopper troubles, cost of nozzles, stoppers, stopper rods and sleeves, although in some instances the extremely hot acid electric metal required for light, thin section castings caused an actual fusion of the stopper rod.

Metal poured from a bottom pour ladle into a shank ladle stays hot longer and is freer of slag. There is no labor involved in skimming the large ladle, thinner castings may be expected and the amount of skull will be reduced in both large and small ladles.

On account of the weight and volume of metal involved, lip ladles with a greater capacity than 4 or 5 tons usually are not used in steel foundries. For heats of this maximum weight, usually they are used only for converter and electric steel of high temperature. Large quantities of open-hearth steel never is poured over the lip of the ladle. This is due to the comparative rapidity with which the metal chills after it is skimmed. The metal loses fluidity and causes ladle skulls and misrun castings. This condition does not obtain with hot converter or acid electric steel on account of the high temperature, extreme fluidity and the comparative ease with which most of the slags may be removed from the surface of the metal.

Hold Converter Metal

As a result of this high temperature it is quite common practice in handling converter metal to hold ladles from 5 to 10 minutes after the slag is skimmed from the surface before pouring thick or heavy castings. This practice of holding the metal is highly commendable and in some instances actually mandatory where the castings have to meet severe specifications. The entire bath is permeated with finely divided slag particles incident to the converter process of making steel. The standing period affords these particles a chance to float to the surface. Converter metal held for a brief period—merely a part of good converter practice—will meet any reasonable test to which the casting is subjected.

Where the metal is poured over the lip, slag constantly rises to the point from which the stream is drawn instead of away from that point as in bottom pouring practice. Physical tests show a wide variation in similar castings poured according to the two methods.

The use of teapot ladles is quite common in handling converter or electric steel. Most of the objections to lip pouring are overcome insofar as slag is concerned whether acid or basic. Protective covering of the slag referred to previously is present and since the stream is drawn from the bottom of the bath, the slag rises constantly from the vicinity of the exit and castings free from slag particles may be expected.

However, trouble may be expected in a teapot ladle if the spout freezes before the ladle is emptied. This contingency rarely occurs with the hot metal usually found in converter and electric furnace shops manufacturing thin section, small castings. Great care and haste must be exercised if heavy skulls and high labor costs for chipping are to be prevented and frequent lining of the spouts avoided. Even with teapot ladles, skimming in the spout often is necessary on account of the constant accumulation of slag over and around the opening.

Small bull ladles of 1000 to 2000 pounds capacity are used extensively in converter and electric steel foundries. They are filled from the main ladle containing the entire heat, or, in some instances directly from the furnace or converter spout. They may be skimmed readily and thoroughly and can be used for pouring steel into small molds comparatively close to the floor. They will not develop skulls where the metal is hot and may be used repeatedly without chipping or relining, as in ordinary gray iron foundry practice.

The pouring problem involves the size of the mold or the volume of metal, temperature of metal in the ladle, and the time necessary to transfer the metal from the ladle to the mold to get the best results. For a given volume of a certain temperature, the time required to make the transfer to accomplish the best results may vary greatly on castings of similar weight, but dissimilar shape. For example a 2000-pound thin section castings of great superficial area should be poured much more rapidly and with much hotter metal than a casting of similar weight but smaller in size and thicker in section.

Time Determined by Experience

On a new job the correct time can be determined only by judgment and experience. This feature increases the hazard which always accompanies the production of single large steel castinges. So many jostling factors are involved that it seems impossible to lay down a set of rules that can be applied absolutely for the guidance of the foreman, or other person directly responsible for the production of perfect castings.

According to records kept in various foundries the actual elapsed time for pouring steel castings may vary from a few seconds for a snap flask mold to 25 minutes for castings weighing 150 tons. In the latter instance four bottom pour ladles were employed simultaneously and the metal entered the mold through three 5-inch diameter brick runners. Risers on these castings did not solidify until 3½ hours after the castings were poured and the castings still showed a dull red color when they were stripped 14 days later.

Since the rate of pouring a given casting should be determined partly by knowledge of the temperature of the metal, it is quite important that the approximate temperature as indicated by the fluidity should be determined and the information conveyed to the man in charge of the pouring operation. The ordinary spoon test taken immediately before the metal is tapped from the furnace supplies this information in a practical and easily understandable form.

This practice may be standardized to the extent that the foreman can order from the melter metal suitable for light or heavy castings in terms of the number of seconds required for the spoon test metal to solidify. Where he orders 80-second metal for small thin castings and the spoon test shows only 65 seconds, the man directing the pouring confidently anticipates a number of missrun castings.

Where a miscellaneous line of castings is produced the usual practice is to pour the smaller castings with shank ladles filled from the bottom pour main ladle containing the entire heat. If the initial temperature is not as high as desired, part of the steel may be poured from shanks and the remainder of the metal poured directly from the main ladle into the heavier castings. Temperature of the metal is an important phase of the subject and should be accorded critical attention and intelligent study.

An almost infinite number and variety of exceptions constantly require ripe experience and keen study. Even where the temperature of the metal is fairly well known, the man in charge must know or rather must be in a position to estimate closely how long it can be kept in the best condition to pour the castings on the floor for any given heat. Also he must determine in advance the order in which the various castings should be poured according to comparative area, weight, section and intricacy, liability to crack, check, burn in etc. This involves maintenance of a nice balance. A great many factors constantly must be given consideration in their relation to each other, a combination that keeps perfection of accomplishment just out of reach.

Estimate Pouring Speed

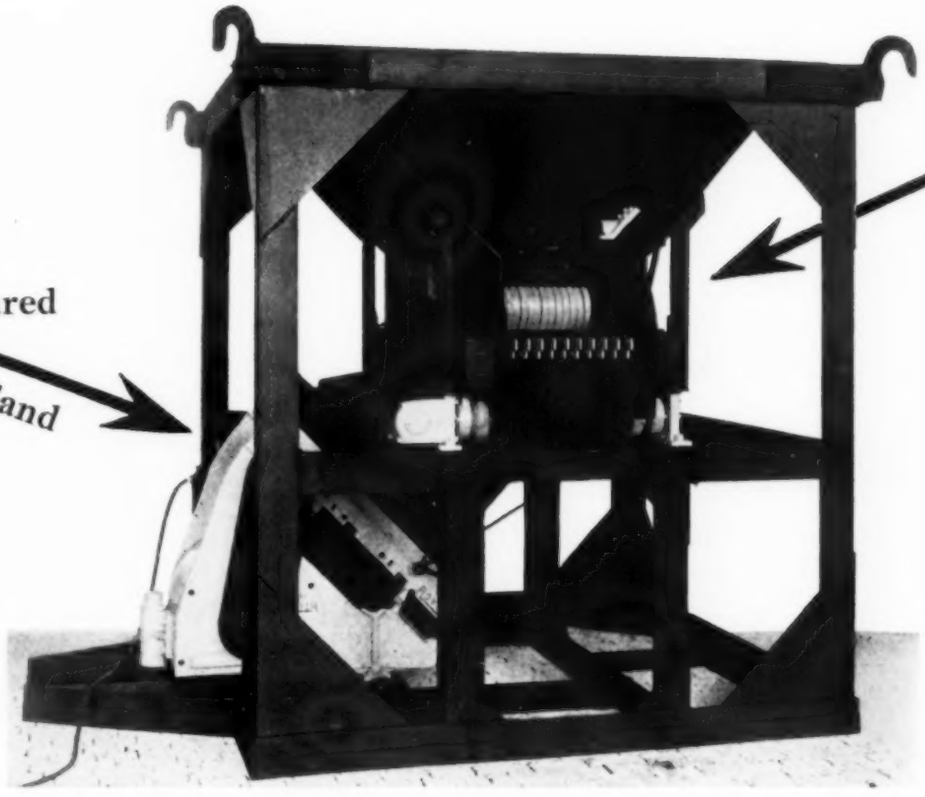
Speed or rapidity of transferring metal from the ladle to the mold is controlled by the size of the runner and gate or gates and for large castings especially these sizes must be determined from a general knowledge of the laws governing the flow of liquids under static pressure. This point has been touched upon previously.

The most desirable time in which to fill a given mold of large volume usually depends on the judgment and experience of the operator. This judgment and experience in turn are predicated on section, area and volume of the casting. Manifestly the upper limit is determined by the size of the ladle nozzle. Irrespective of any increase in the size of the gate over that required to absorb the

(*Concluded on page* 46)

The ROYER

in One Operation!



The Royer Combination of Scrap Remover and Sand Separator and Blender is without doubt one of the most adaptable of all the various sand preparing units ever offered to the trade.

At a minimum of trouble or expense this unit can be installed in any sand handling system and fed by mechanical means, or it may be transported from place to place on the main floor by means of a traveling crane and fed by crane and grab bucket.

NRA MEMBER U.S. WE DO OUR PART

In a few minutes by releasing two bolts The Royer Sand Separator and Blender can be removed from this unit, placed upon wheels (supplied with this combination) thus becoming a distinct and portable unit, which can be moved to the side bays to prepare sand for bench work; or be placed under the discharge spout of any muller for the final preparation of facing sand.

This machine is worthy of serious consideration and will save money in many ways.

ROYER FOUNDRY & MACHINE CO.

KINGSTON STATION — ROYER PRODUCTS RECOMMEND THEMSELVES — WILKES-BARRE, PA

REPRESENTATIVES

Alexander Haigh, Boston, Mass.
David D. Baxter, Rochester, N. Y.
Engineering Service Co., Roanoke, Va.
Fenton Foundry Supply Co., Dayton, O.
Rapp & Hollins Inc., Chicago, Ill.
Snyder Foundry Supply Co., Los Angeles, Calif.
Pacific Graphite Works, Oakland, Calif.
Western Foundry Sand Co., Seattle, Wash.
Wm. S. Edgar, Engineer, Pittsburgh, Pa.

Distributed in Canada by Canadian Foundry Supplies & Equipment, Ltd., Montreal, Que. and Toronto, Ont.
Manufactured in Great Britain by Pneulec, Ltd. Smethwick, near Birmingham
Manufactured in France by Fenwick Freres, 8 Rue de Rocroy, Paris

(*Concluded from page* 44)

stream from any given size nozzle, no increase can be effected in the speed with which the metal is transferred from the ladle to the mold.

Instead of one large opening, the gate may be divided into two or more passages for a better distribution of the metal. Also, and this applies particularly to large molds where the metal has to rise a great distance from the bottom, the vertical runner is connected by two and in some instances three gates to the mold. One is located at the bottom, one midway between top and bottom, and one at or near the top. The half way gate is highly desirable since it admits fresh hot metal to the casting at about the time the metal which entered at the bottom is beginning to cool. Also entrance of metal at this point relieves the pressure on the bottom gate. Under the new balance thus set up the remainder of the metal required to fill the mold will enter through the second gate and thus promote solidification of the casting from the bottom upward. In the event that a third gate is provided to deliver metal at or near the top of the casting, entrance of metal through the middle gate will cease when the metal in the mold arrives at the level of the top gate. Thus the last and hottest metal enters the mold at the top, the ideal condition to promote feeding.

Gates on small castings may be Y-shaped, fan, horn, or straight according to the design of the casting. They must be arranged in a manner to prevent the metal from cutting or washing the sand, or trapping air. Metal should be introduced into the mold at the point least likely to cause cutting or disturbance of cores or mold walls.

Prevent Cracked Castings

Consideration must be given to the possibility or probability of hot or cold cracks developing upon solidification of the metal or during the cooling and shrinking of the casting. The problem is complicated further by the necessity of attaching the gates in a manner that will facilitate their removal with a minimum expenditure of time and effort in the cleaning room. In many instances gates may be designed and used as feeders for small and medium size castings and occasionally the metal may be poured directly through the feeding head, thus eliminating the necessity for the additional and ordinary runner and gate.

Since alloy steel castings now are made extensively it may be pertinent at this point to note that risers on chrome-nickel steel castings, particularly of the 18-8 type can be cut successfully with an injector type cutting blow pipe. As considerable heat is necessary it is recommended by the makers that one size larger nozzle be used than would be the case when working on plain carbon steel castings.

Preferably the nozzle should have six preheating jets instead of the usual four or less. Oxygen hose should be ⅜-inch diameter to obtain ample volume. Oxygen pressure needs to be increased perhaps 15 to 20 per cent over the pressure required for cutting plain carbon steel casting. It is claimed that a skilled operator will sever a 6 x 6-inch riser in from 3 to 3½ minutes cutting time.

This is the fifty-second of a series of articles dealing with the various types of gates and risers used in the foundry industry. The fifty-third installment will appear in an early issue.—The Editors.

Joins Sales Force Of Pittsburgh Company

Day E. Cutler, for the past 8 years connected with the Pittsburgh office of the General Electric Co., Schenectady, N. Y., in the sale of cupola blowing equipment, has accepted a position with the sales force of the J. S. McCormick Co., Pittsburgh. Mr. Cutler was graduated from the Virginia Polytechnic institute, in 1922, with a degree in mechanical engineering.

Day E. Cutler

Publishes Research on Impact Testing of Iron

American Society for Testing Materials, 260 South Broad street, Philadelphia, recently has published "Impact Testing of Cast Iron" dealing with several forms of that type of test. The research work, which is reported in a comprehensive series of data, extended over a period of three years, and the correlation of data was handled by subcommittee XV on impact testing of the A. S. T. M. of committee A-3 on cast iron group. That group enlisted the cooperation of other prominent workers in the field of cast iron.

Some 500 test bars were cast, machined and tested specially by the several methods investigated and on the various types of machines in commercial use. Extensive tables in the publication give the results of the transverse, tension, fatigue, compression and shear tests which were made, and by use of charts and illustrations, these data are condensed in convenient form.

Notched and unnotched Charpy and Izod tests were run, as well as repeated blow and drop tests. The conclusion of the committee in charge are included, as is a chapter on the microstructure of irons in the impact investigation.

Copies of the report may be obtained through the offices of the society for 50 cents.

Elected President of Grinding Wheel Group

Frank R. Henry (see family album on page 34) vice president and manager of sales, Simonds Worden White Co., Dayton, O., recently was elected president of the Grinding Wheel Manufacturers association. Dr. Henry served as secretary of the association since its organization in July, 1924. He also is president of the Ohio Ceramic Industries association, Ohio State university, Columbus, O.

Malleable Cost

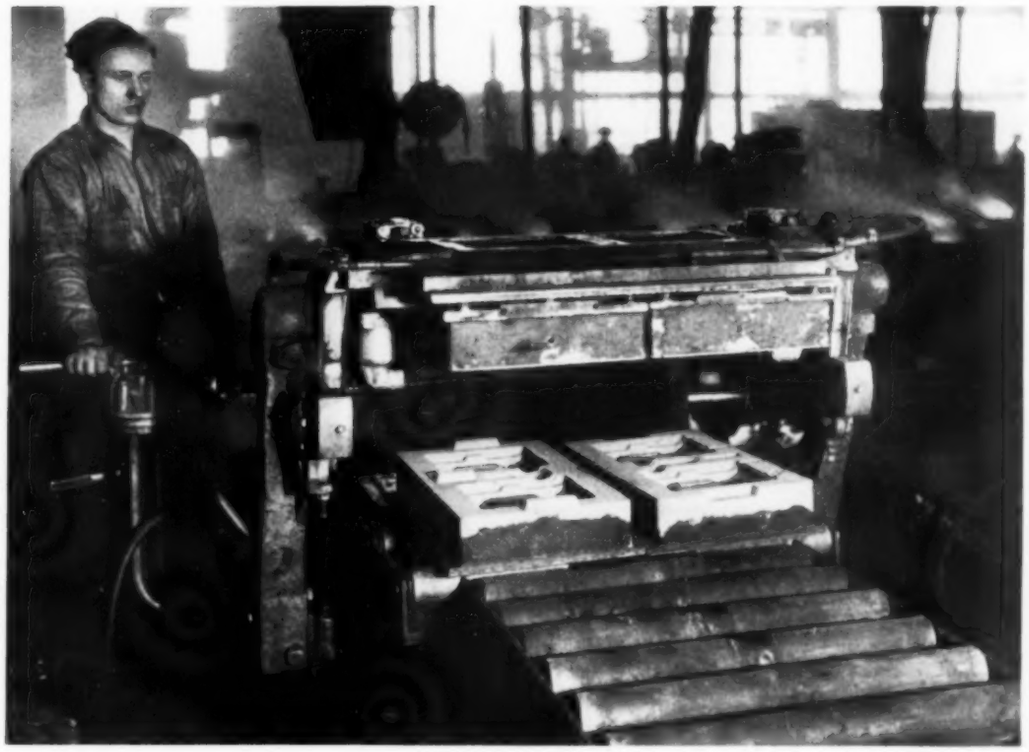
National Recovery Administrator Hugh S. Johnson approved on April 25 the uniform method of cost accounting for the malleable iron industry, as submitted by the industry's code authority in accordance with requirements of the code. At the request of the code authority the approval was given for a trial period of 90 days, during which time reports will be made to indicate whether the method adopted is functioning properly. The provision for a waiting period between time of filing and effective date of price lists also was suspended.

Elects Group Officers

E. F. Ross, associate editor, *Steel*, recently was elected chairman of the Cleveland chapter of the American Society for Metals. Other officers are as follows: Vice chairman, H. B. Pulsifier, metallurgist, Ferry Cap & Set Screw Co.; secretary-treasurer, G. T. Williams, sales metallurgist, Cleveland Tractor Co.

IF IT'S A HERMAN IT'S WORTH USING. IT MADE ITS WAY BY THE WAY IT'S MADE

HERMAN MOLDING MACHINES



Molding In Cores

The 750-lb. Series Herman assures proper ramming, clean draws, and speedy operations. It is unnecessary for the operator to leave the control valve as the finished cores are deposited directly on the conveyor.

Perhaps your work is applicable to this method of molding. Real production may be obtained.

Why not investigate? We solicit your inquiries.

HERMAN PNEUMATIC MACHINE COMPANY

GENERAL OFFICES: Union Bank Building PITTSBURGH, PA.

MANUFACTURING PLANT: ZELIENOPLE, PENNSYLVANIA, U. S. A.

Foreign Works: Pneulec Limited, Mafeking Rd., Smethwick, near Birmingham, England

Hartung Aktiengesellschaft, Berlin, Lichtenberg, Germany

Gibson Battle & Co., Limited, Sydney, N. S. W.

Faces Shortage of Trained Men

(*Concluded from page* 21)

tives, why go to the inconvenience of learning the trade?

The foundry has lost prestige and power to attract the younger generation, principally through the psychological effect of the way in which this problem has been handled.

The old rule of thumb method in the foundry has been supplanted by modern technique and science. There is no valid reason why foundry work cannot and should not be made attractive to any young man. The employer should encourage and stimulate a desire by recruiting young men from the ranks. Young men who have demonstrated desire and ability to become leaders and executives.

Slackness of foundry activities for the past 4 years has resulted in a decided drop in the potential supply of trained foundry executives. Whatever training was carried on in a few plants has been curtailed greatly if not entirely suspended.

Many Men Forced Out

Through unfavorable business conditions foundry executives and assistants have been forced out, never to return. Others have been let out, due to advanced age. This latter group doubtless is greater in proportion, than during normal times. Little attention is paid to a man's age when everything is humming and the plant is busy.

To secure qualified men for the foundry in the future, foundry owners must interest themselves in this cause. With a few notable exceptions, the owners have stood aloof individually and collectively. If they were asked: "Have you trained men, equal in number to those required to operate your plant?" the majority would answer in the negative. Probably a more specific answer would be: "The training has been more or less accidental, I had nothing to do with it." If this is the case—and the evidence points in that direction—the owners are guilty of indifference or even neglect, detrimental to their own interest.

To rehabilitate the neglected profession a number of plans may be suggested. Any plan must include practical training and technical education.

The principal difficulty will be found in choosing the right material, young men most likely to finish the course. The boys should be selected from among high school students, graduate or non-graduate. Boys who have entered institutions of higher learning are not likely to take up anything as plebian as sand shoveling.

These boys would be given work in the foundry with the understanding that they are to learn the trade, also that proper guidance will be given in furthering their education to equip them properly for responsibilities later to be placed upon them.

While serving their time they should work in all departments long enough to secure a thorough knowledge of the work at hand. When the course is finished they should be able to hire out as core makers, molders, etc.

Many will say this will take too long a time to appeal to young men. Not at all, and if it does take time, what of it? Anything worth while will take time to learn. All boys want to learn something or other and the problem is to get the right boy in the right place.

For illustration assume that a boy of 16 or 17 with 2 years in high school enters the foundry under a definite plan. He starts in the core room on odd jobs. After a few weeks he is put on the bench making small cores. As time goes on and he shows inclination and adaptability to his new work he is given work of more intricate and exacting character until he is able to make any core that comes along. For a young man of fair intelligence and under proper tutorship, 12 months should be sufficient.

Beginning the molding stage, he will have to be content with plain and simple work at first, for example, a plate on a squeezer. After this should follow the gated pattern, also on the squeezer. Next stage embraces loose patterns on the bench and finally floor molding. Some time prior to taking up floor molding the apprentice should put in some time on a molding machine.

A tentative time schedule follows: 12 months in the core room; 6 months on a plate pattern; 6 months on gated patterns; 3 months on machine; 6 months on loose patterns bench; 12 months on floor work; 3 months on cupola and miscellaneous work. The apprentice now has received his practical training but what about his technical education?

If the apprentice is of the right type he will have taken special courses in evening school during these 4 years, or where this is not convenient, in some correspondence school of which there are several furnishing good courses in this field. The subjects to be studied and the intensity with which this study should be pursued depend on the education the apprentice already has received. However, the following subjects may be considered: Mathematics, physics, chemistry and mechanical drawing.

Following the 4 years of apprenticeship the future executive enters a technical school to round out his education. The type of school and the time necessary will be governed by the knowledge the individual student has acquired up to this time. As this schedule includes spare time study for the four years of apprenticeship it should be surmised that the student has acquired a fair amount of knowledge appropriate to his chosen occupation. One to 2 years in a technical college therefore should make him quite a capable man.

Upon his return to the foundry it is advisable to work in the office for some time to familiarize himself with the detail work of time and other record keeping systems, estimating, cost figuring, etc. A simpler plan may be developed for those who consider this plan elaborate or too exacting.

With the college graduate, a somewhat different plan must be followed. He is 5 to 6 years older than the other boy at the start. His ability to observe and to learn is greater due to his training and higher mentality. The time required to acquire the necessary practical knowledge may thus be reduced. However, he should not consider it above his dignity to do ordinary hard work in the foundry.

In the main, the plan should be the same as the one already outlined. Time may be reduced for some work. For example, the total time for molding on plate, gated pattern, loose patterns and machine is 21 months for the apprentice of high school age. A total of 6 months may be found sufficient for the college man. The time for floor molding should be increased in view of the shorter time allowed for other branches of molding.

What Should Govern Cupola Slag?

(*Concluded from page* 19)

In such cases it has been found that a good dose of sharp sand acts as a strong cathartic and soon removes the infection. It is believed that where very refractory materials, such as those used in the melting zone patch of the cupola are subject to slag formation, some strong acid acting materials such as sand could be used to great advantage and at very little cost. One hundred fifty pounds of slag per ton of iron melted would not seem at all excessive.

One would naturally assume that the more slag made the greater would be the requirements of coke, but in blast furnace practice, of course up to a certain limit, this does not work out and such may also be the case with a well operated cupola.

ADVERTISING PAGES REMOVED

Future of the Foundry Industry

(*Concluded from page 23*)

where he may see bad castings and study their causes, ultimately will make an interpreter worth while. He cannot be expected to be worth while till he learns the foundry end.

It is not feasible to demand that the university give instruction in foundry practice beyond a very few fundamentals. The available equipment generally is too antiquated and the instructors cannot themselves have had the experience in all foundry branches to turn out students who are finished foundry products. There is no sense in wasting college years in trade school work that in any event is better assimilated when it is obtained under the incentive of trying to hold a job. If the graduate had a broad training in the fundamentals of science and in scientific methods of thought so that he does not take as gospel anyone's say so on how a thing should be done, but analyzes the problem into its essential features and studies its interrelationships, he is in good shape to apply the technical facts he knows or can find out to foundry questions he has to solve.

Start with One Engineer

Technically trained foremen, superintendents and managers are becoming the rule in industry, and it is that type which offers the foundry its greatest hope for survival and advancement.

The small foundry usually will start with one technical man, and as he decreases the scrap losses, builds up specialties, makes it possible to bid on and successfully produce material to meet exacting specifications and the plant becomes profitable and grows, he will be given assistants, technical equipment and laboratories, and library facilities. Ultimately beside these facilities for routine control, he will need a research department either in his own plant or at some institution to which he farms out the problems that need more adequate attention than they can be given by the production and control staff.

The technical interpreter needs to be in close touch with a wide field in which scientific advances are being made. Take the mere fact that low carbon alloy iron castings are found more suitable for certain automobile crankshafts than more expensive forgings. This will open up in the minds of other users the question of whether similar substitutions cannot be made, and they will come to their local foundry for information on the possibilities.

Co-Operation

UNDER our present system of planned economy, many new problems face the foundry industry. The author of this article, which is from a paper presented at the recent foundry conference held at Ohio State university, Columbus, O., believes that only through co-operation and the free exchange of information can the industry be prepared for the work of the future. This swapping of ideas, as now is done in one of the major industries, is considered the only effective way for the technician in the foundry to keep abreast of the times, to keep in touch with what is being done by others, and to forge ahead on his own problems. The author is chief technical adviser, Battelle Memorial Institute, Columbus.

A knowledge of whether the castings desired can be made in existing cupolas by use of all steel scrap, or whether electric melting or powdered coal furnaces will be required to get metal of proper composition and fluidity, is necessary. Effect of various alloying elements and their combinations, the possibility and practicability of heat-treatment, the machineability and wear resistance of the alloys all are factors. Information on all of this is available to some degree and would be findable by the well-read, technically trained men, but it would be hard to locate and utilize without the aid of such a man.

The steel castings industry is becoming very alloy-conscious. It is becoming clear that all the alloy combinations and gradations used in the wrought steel industry are applicable to cast steel and the full heat-treatment of steel castings by quenching and tempering is being applied to pieces that not long ago would have been considered impossible to quench. Hence, the foundryman who wants to get the business that calls for castings of special properties must be conversant with fields of metallurgy that formerly were not considered even to touch the foundry field. The brass foundryman no longer covers his field with 85 and three 5's and phosphor bronze, he must be prepared to utilize the newer precipitation-hardening alloys, such as beryllium copper and the nickel silicide and nickel aluminum hardened copper, brasses and bronzes, just as the aluminum foundryman has to deal with a lot of special mixtures instead of relying wholly on No. 12 alloy.

The advent of tungsten and tantalum carbide tools puts into the field many hard, wear-resistant cast alloys that formerly were uneconomical because they could not be machined. The same tools facilitate machining of some gummy aluminum alloys and swing the choice to those alloys for some uses. Thus advances outside the foundry industry itself react upon it, and those who can see what changes are due to occur and chart their course accordingly will profit quicker. Competition among different methods of fabrication, forging, pressing and welding against casting, centrifugal casting against ordinary methods, permanent molds, pressure casting and die casting of suitable alloys against sand casting of other alloys all tend to make for small certainty that anything now used for a given purpose will hold that use against something made by a different method. The pressing and sintering methods used to make tungsten carbide tools are being extended into so-called *powder metallurgy* that increasingly will compete with casting.

As castings are extended into fields formerly held by forgings and assurance is required against failure from hidden flaws, radiographic examination is called for, and its possibilities and limitations as an inspection method and as a means for developing correct gating need to be understood.

Why Castings Are Lost

Not all of the foundry problems relate to metals. Many wasters are ascribable to molding sand or wrong permeability and wrong moisture content. Core blows and hard cores come from wrong core sand, wrong binder or wrong baking practice. Much waste of fuel and high repair costs come from wrongly chosen refractories. Proper combustion of fuel and the choice of fuel for best overall efficiency take the foundry technician into still other fields. Yet every one of these things deserves the application of the best knowledge available, just as each part of the automobile calls for constant technical study for improvement.

How is the technician in the foundry going to keep abreast of the times and keep in touch with what is being done by others, as well as himself, to forge ahead on his own immediately pressing problems? There is only one effective way to do it, and that is by swapping information.

Fortunately, everyone else is in the same boat and this community of interest led long ago to the formation of the American Foundrymen's association whose purpose is the

continued education of the foundryman and his advancement in every way. This and the other technical societies, and the technical journals not connected with societies publish articles on both scientific and operating advances that put on record the answers to many questions every foundryman needs to have answered.

The task is not done when men are trained and new facts are presented in articles. One cannot always be on the receiving end, and expect to have information obtained by others and supplied to him. He must co-operate and swap information. He can at least join the A. F. A. and let his dues help the cause, but a large membership of dues-paying but speechless foundrymen would not make a useful association. The members should help by preparing articles for the A. F. A. and the other journals when they have something to pass on, and should add their bit in the discussion of the papers at the meetings.

Foundry conferences serve to make acquaintances out of strangers and friends out of acquaintances so that these friends visit each other and each others' plants, write to each other about their mutual problems in a spirit of mutual helpfulness. They do much toward hastening the day when knowledge will be more fully applied to the foundry, when we no longer will be satisfied to do things in the same old wasteful way, but will have found a better way and passed it on to our fellows.

When that day is fully here, foundrymen will be in better shape to withstand the hardships and vicissitudes that face them today.

Simplify Casting of V-8 Cylinder

(*Concluded from page* 17)

blacking and the surface of the mold in the 3-minute period required for the journey.

Immediately as they emerge, the drags are lifted and transferred to the long conveyor leading to the pouring station. Cores are set in place by a succession of operators while the drag is in motion. Referring again to Fig. 3, the valve housing core *B* is set first and is followed in turn by the gear case core and lightener at the ends. Then the right and left barrel assemblies *C* are slid into place and finally the crankcase core *G* is lowered into place.

To facilitate setting the barrel core assemblies and to prevent the core from scraping the slanted skin dried surface of the mold, thin strips of steel are laid upon the mold surface before the core is lowered. After the core has been set safely in place, these steel strips are withdrawn. Vent openings from these cores lead to suitable openings in the sides of the flask. The valve housing core is vented through the bottom and the crankcase core through the cope and one end of the flask.

As each cored drag passes the vicinity of the cope making station, a skin dried cope is lifted, inverted and lowered into position on the drag where it is clamped in place and a runner basin placed in position.

Following a short passage from the pouring station, the flasks containing the castings arrive at the shakeout station. The cope is removed first and placed on a bumper which shakes all the sand through a grating and onto a belt which carries it to the reconditioning equipment. The empty cope is sent on its way to the cope making unit, there to start once more in the cycle of operation.

An operator attaches the jaws of a special grip suspended from an overhead conveyor to the casting and it is carried away for an aerial cooling trip above the roof. Finally the casting is deposited in a second story cleaning room where it is blasted, chipped, ground, inspected and then sent to the machine shop.

Sand from the drags falls through an opening in the floor and joins the sand from the copes on the journey to the department where the sand is reconditioned. The bottom plates and the empty drags are returned by an auxiliary conveyor to the drag making station.

Presents Data on Soil Corrosion Study

A report entitled "Soil-Corrosion Studies, 1932. Rates of Loss of Weight and Pitting of Ferrous and Nonferrous Specimens and Metallic Protective Coatings" by K. H. Logan and R. H. Taylor, recently has been published by the bureau of standards. The report is part of a study of the action of soils on buried pipe, begun in 1922 by the bureau, and deals only with specimens removed in 1932. It is pointed out that consideration of these data does not materially alter conclusions reached earlier that the character of the soil controls the rates of corrosion of ferrous materials and that in the same soil all of the commonly used ferrous materials corrode at nearly the same rate.

The report may be secured through the superintendent of documents, Washington, for 5 cents.

The code of fair competition of the scrap iron, nonferrous scrap metals and waste materials trade was approved by the President on March 13 and became effective on March 26.

Approves Code Authority Appointments

National Recovery Administration recently announced its approval of the code authorities of the steel castings industry and the nonferrous foundry industry.

The steel casting industry is as follows: D. C. Bakewell, president, Duquesne Steel Foundry division of Continental Roll & Steel Foundry Co., Pittsburgh; E. L. Brooks, treasurer, Sawbrook Steel Casting Co., Cincinnati; E. H. Cornelius, president, Oklahoma Steel Casting Co., Tulsa, Okla.; J. W. Glover, president, Glover Machine Works, Marietta, Ga.; F. A. Lorenz Jr., vice president, American Steel Foundries, Chicago; R. E. Noack, secretary-treasurer, Monarch Foundry & Engineering Corp., Ltd., Stockton, Cal.; Clarence Tolan Jr., vice president, Dodge Steel Co., Philadelphia; and Keith Williams, vice president, Pratt & Letchworth Co., Buffalo.

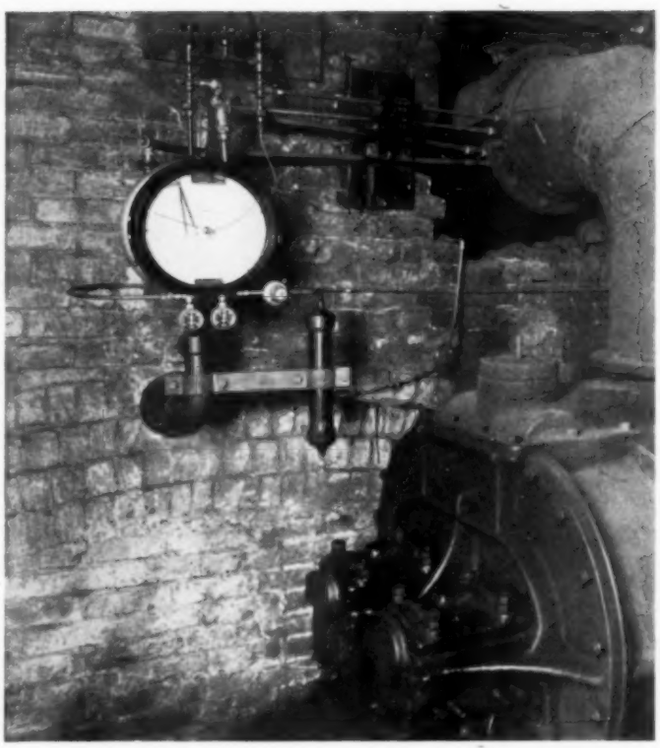
The nonferrous foundry industry code is as follows: N. K. B. Patch, Lumen Bearing Co., Buffalo; A. B. Norton, Aluminum Co. of America, Cleveland; H. W. Holt, Bohn Aluminum & Brass Corp., Detroit; H. A. White, National Bearing Metals Corp., Pittsburgh; James L. Wick Jr., Falcon Bronze Co., Youngstown, O.; and N. H. Schwenk, Cramp Brass & Iron Foundries Co., Philadelphia.

Code authority for the die casting manufacturing industry is as follows: Members at large, F. P. Assmann, president, Precision Castings Co., Inc., Syracuse, N. Y., and H. H. Doehler, president, Doehler Die Casting Co., Toledo, O.; Eastern Region—G. M. Rollason, general manager, Die Casting division, Aluminum Co. of America, Garwood, N. J.; Central Region—H. H. Weiss, president, Superior Die Casting Co., Cleveland; Western Region—S. A. Hellings, vice president and general manager, Stewart Die Casting Corp., Chicago.

The code authority for the chilled car wheel manufacturing industry follows: E. P. Waud, vice president, Griffin Wheel Co., Chicago; J. A. Kilpatrick, president, Albany Car Wheel Co., Albany, N. Y.; W. F. Cutler, president, Southern Wheel Co., New York, and D. H. Sherwood vice president Maryland Car Wheel Co., Baltimore.

Celebrates Anniversary

United Compound Co., 228 Elk street, Buffalo, manufacturer of vent wax, is celebrating the twenty-fifth anniversary of the establishment of the business. The company was founded by John W. Bradley, who retired from active management several years ago, and now is directed by Leslie F. Leney, manager and William F. Bradley, treasurer.



CONTROLLED AIR WEIGHT IMPROVES CUPOLA OPERATION

You weigh your coke and iron — why not weigh the air too, and control its weight automatically. Automatic control of air weight results in the following improvements in cupola operation:—Uniform melting temperatures — elimination of "burnt" iron — saving in coke — more uniform castings — longer life for cupola lining — savings in power consumption.

The Foxboro Air Weight Controller automatically controls the weight of air being delivered to the cupola. It is *not* an expensive instrument and is extremely simple to install and operate. It can be used with *your present blower equipment*. The rate of flow of air is recorded on a circular chart graduated in pounds per minute or in terms of standard cubic feet.

A definite weight of air is delivered to the cupola *under all conditions of atmospheric temperature and barometer*. The Foxboro Air Weight Controller has a control mechanism that compensates for all changes in these conditions.

The possibilities of savings with this instrument should be investigated at once. Write for folder No. 610 and get complete information. This will in no way obligate you.

FOXBORO

REG. U. S. PAT. OFF.

THE COMPASS OF INDUSTRY

THE FOXBORO COMPANY, FOXBORO, MASS., U.S.A.

BRANCH OFFICES IN PRINCIPAL CITIES

• • COMPLETE INDUSTRIAL INSTRUMENTATION • •

Discover Ancient Bronze in Sweden

(*Concluded from page* 25)

holes in the area subjected to the greatest heat. The writer frequently has observed the same phenomenon in conducting heat tests on clays used in Swedish foundries. Traces on the inside of the pots indicate that a paste of some kind was employed either for patching purposes or to increase the refractoriness.

Since larger crucibles have not been found here or at any other ancient mound, and since castings greater in weight than the capacity of a single crucible are in existence, it seems reasonable to infer that the larger castings were poured from two or more crucibles through two or more sprues. Many castings are extremely thin, and this feature also lends color to multiple runner hypothesis.

The castings found in this latest excavation have been added to the extensive collection in the national museum, Stockholm. Many of the castings in this collection indicate that the ancient Swedish foundrymen were highly skilled molders, melters and finishers. They were familiar with the *cire-perdue*, or lost wax process, two-piece molds and the use of cores.

In the collection are many examples of hollow axes, hollow spear heads, war trumpets, shields, swords, also examples of molds for many of the castings. The ingenious construction of a mold for a hollow axe is shown in Fig. 5. Interesting examples of sprues and gates are shown in the lower part of Fig. 6.

The defective casting shown in Fig. 3, a missrun ornamental double clasp worn by women over their breasts, indicates that even in the early days, foundrymen had their troubles. No doubt at the time the usual alibi was presented by the careless journeyman or by the apprentice whose zeal outran his actual knowledge and experience.

Fig. 5—Typical mold for hollow axe head

From the character of the defect the observer can note that the mold was assembled and poured in a vertical position, or, in ordinary foundry parlance, the casting was poured on edge. The two halves of the mold were not held together closely and the metal ran down between them at the joint, thus creating the extensive fin. A possibility exists that a small portion of foreign material prevented the halves of the mold from coming together, but a more probable theory is that the mold was not properly clamped and the pressure of the metal forced the halves apart.

These clasps are about 9 inches in diameter and weigh approximately 2 pounds. Quite a difference may be noted between castings of this kind found in various parts of the country. Invariably the thinnest castings present the highest degree of skill in the application of the ornamental design and in the manner in which the surface has been finished.

Fig. 6—Collection of miscellaneous bronze castings, also examples of runners attached to two or more gates

Sand Handling Stressed at Quad Cities

F. A. Pampel, foundry engineer, Chain Belt Co., Milwaukee, addressed the members of the Quad-City Foundrymen's association at the regular meeting held April 16 at the LeClaire hotel, Moline, Ill., on the subject of "Sand and Mold Handling." The speaker discussed the present situation in the foundry industry with regard to workmen, and stressed the importance of considering proper equipment for preparing and handling molding sand. He stated that the sand problem is present today in both the large and the small casting shops. Mr. Pampel also showed two reels of moving pictures to illustrate the developments which have been made in mechanical equipment for sand handling and conditioning during the past few years. Considerable discussion followed the presentation of the paper.

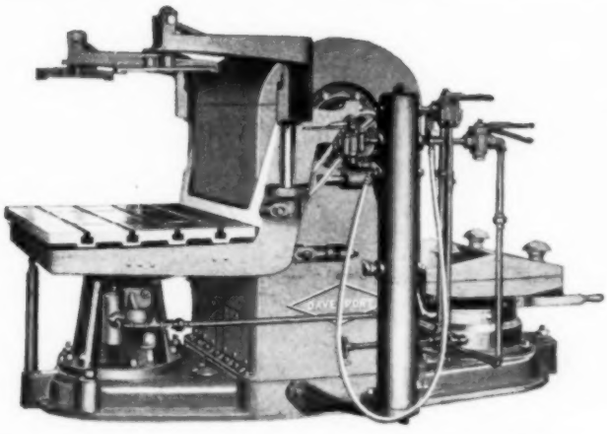
The following were nominated for officers of the association during the coming year in a report of the nominating committee presented by P. T. Bancroft, John Deere Harvester Works, Moline: President, Clyde Burgston, Deere & Co., Moline; vice president, T. F. Frank, Frank Foundries Corp., Davenport, Iowa; secretary-treasurer, J. Morgan Johnson, Tri-City Manufacturers' association, Moline; members of the board of directors, M. J. Gregory, Caterpillar Tractor Co., Peoria, Ill., and Harry F. Henninger, International Harvester Co., Rock Island. Election of officers will be held May 21.

To Handle Pig Iron

Bauer-Wilson & Co., Chicago, have been appointed sales agents in Chicago, Milwaukee and territory west for the silvery and bessemer ferrosilicon pig iron produced by the Hanna Furnace Corp. That company also will handle the special low phosphorous 0.035 pig iron, produced by E. & G. Brooke Iron Co., Birdsboro, Pa., in Michigan, Illinois, Indiana, Wisconsin and Iowa.

Thomas B. Moltrup was recently appointed assistant treasurer of the Moltrup Steel Products Co., Beaver Falls, Pa.

MILWAUKEE
-DAVENPORT-



We can furnish a DAVENPORT
or
MILWAUKEE MOLDING MACHINE
for every Foundry need

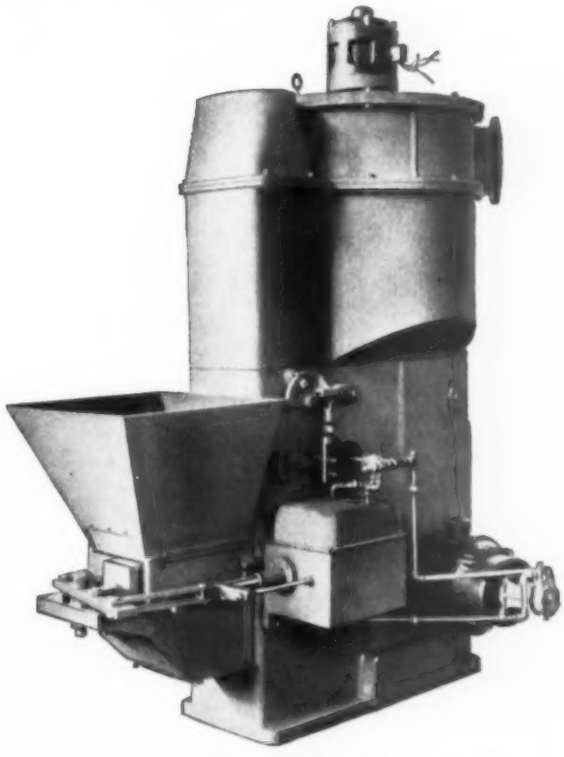
Let us quote on Equipment that is built to serve

A Core Grinder that saves

72″ Diameter Table

UNIFYNE COAL PULVERIZERS and BURNERS

Save Fuel



For OVENS or POWER PLANTS

MILWAUKEE FOUNDRY EQUIPMENT CO.

3238 West Pierce Street
MILWAUKEE, WISCONSIN

The boy expects a great big hand

The Adventures of Bill

BY PAT DWYER

AWAY back in the dim and distant past when I was a bright eyed young lad engaged presumably in the laudable occupation of absorbing a knowledge of the three *R's* at the master's knee—the term teacher was unknown at the time and place—I am afraid I was a source more of irritation than pride to the old dominie. Of course at the time I was utterly incapable of harboring any sage reflection of this character and cheerfully ascribed his cantankerous and crabby disposition to natural cussedness, ingrowing toenails, indigestion and depravity. This opinion, I am happy to say, also was held unanimously by all my confreres and to a certain extent may have been responsible for coloring my views. In later years I have discovered that men find it much easier to accept the views of the majority than to form opinions of their own.

So far as reading was concerned I had little difficulty. I picked up the art readily enough. 'Ritin' presented a perennial and terrible stumbling block. Despite my most valiant efforts, my copy book never failed to arouse the master's derision. The fact that he was justified in holding such a view afforded me little consolation. I dreaded each interview and practically shriveled up inside when summoned to exhibit my handiwork. I held no illusions on the subject. I realized quite as fully as the master that the ink spotted page, covered with wavering lines of mismatched characters never would be displayed on the blackboard for the edification and admiration of visitors. The disheartening feature was that I simply could not do any better. According to the master's opinion I was a total loss, a washout—and I was inclined to agree with him.

Many a salty and bitter tear I shed over my total inability to straighten the backs of the *h's* and *k's*. Instead of displaying a bold and swaggering, upright carriage, these characters limped across the written page like so many decrepit old men, bowed down in the last feeble stages of mental and physical senility. Since that time I have seen stunted trees leaning drunkenly from the perpendicular on bleak and stormy headlands by the sea. Invariably they call up memories of my early attempts to write with a pen.

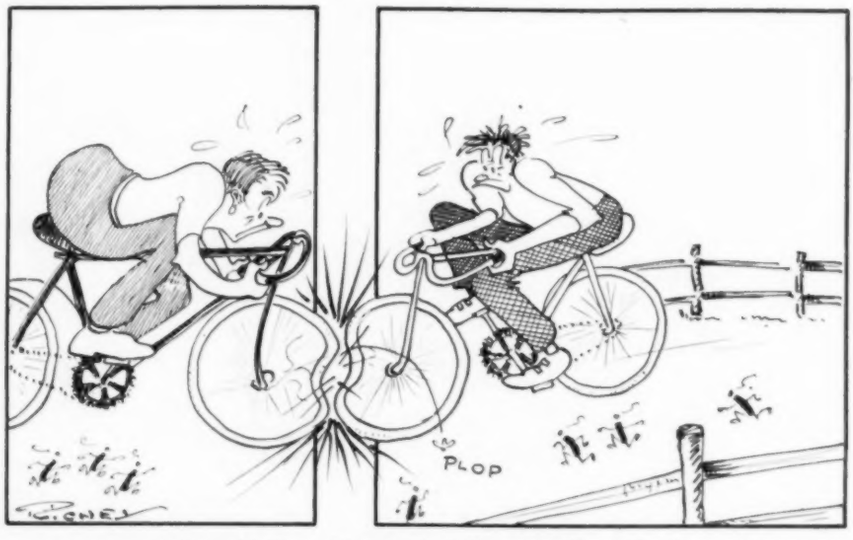
In sporting parlance I was well up in front with the Readers, hopelessly behind with the 'Riters and not even among the also rans with the 'Rithmetickers.

Eventually I acquired sufficient skill to write a fairly legible hand, provided I was not unduly crowded at the barrier or when rounding the turns. Under stress of racing conditions it is possible that the letters in some of the words blend into an unrecognizable mess, but with a little patience one may gather the general meaning of any given sentence. When I write to a friend he accepts the will for the deed and says to himself: "Oh, well, the old boy's heart is in the right place even if his fingers are all thumbs." When I write to an enemy he imagines that some of the ilegible words are of a deeply insulting character and as the boys say down around the pool rooms, "That is all to the good and perfectly hotsy totsy!"

The last of the three *R's*, 'rithmetic, proved the hardest nut to crack. I clawed and hammered on it for years without making any appreciable dent in the shell. Possibly a lack of imagination was responsible for my failure to solve any of the problems. I could not put myself in the place of John Doe who had borrowed $357.46 with interest compounded semianually and who was keenly interested in how much he owed the bank at (a) three months and four days and (b) on Nov. 3 of the calendar year in which the loan had been negotiated.

Frankly ,my attitude was that John was wasting his time—and mine—in working on this problem. At the end of any given period the bank would furnish him with a statement complete to the last penny and John would have to pay that amount—or else! He could figure until he was black in the face. He could call in all the king's horses and all the king's men to prove that he was right and the bank was wrong, but the bank would collect the full amount with an extra charge of $2.76 because the dispute had carried over to the second day of the following month.

(*Concluded on page* 59)



Seems to be a dead heat, folks. All bets are off

(*Concluded from page* 56)

Activities of the three mythical characters *A*, *B*, and *C* in digging drains and cellars, piling bricks, carpeting and papering rooms or laying shingles with 4 inches exposed to the weather, failed to arouse any interest. The various factors in one of these problems seemed to chase each other around and around in a circle. I never could pin one down to serve as a starting point. Some of the more highly gifted lads in the school could take one of these problems, arrange the points mentally in proper sequence and furnish the correct answer without touching a pencil to paper. I could work at the same problem for an hour, cover three pages of paper with useless calculations and then find that the answer was 31 days and a fraction instead of seven barrels, 11 yards or $11.57.

Bill takes advantage of this weakness occasionally by propounding problems for which he knows the answer in advance. If I had sufficient strength of will, I should repulse him sternly when he submits one of these teasers, but alack, the fatal streak of vanity which seems to afflict all men prompts me to attempt what I know in advance is a hopeless enterprise.

"Say, listen," he said the other night. "Here's a little problem been going the rounds of the shop for a couple of days. See what you can make of it."

"Do you know the answer?"

"Sure."

"Then why do you want to bother me with it?"

"Well, I'll tell you. The thing while apparently complicated really is quite simple. I am curious to learn whether the solution comes to you spontaneously, or if it is over your head.

"Two bicycle riders, John Doe and Richard Roe, start from opposite ends of a 20-mile straight track and ride at a speed of 10 miles per hour until they meet in the center. A fly which for purpose of identification we shall call Jimmy Bo is perched on the handle bars of John Doe's bicycle before the race starts. Jimmy has a flying speed of 15 miles per hour. At the crack of the gun all start together. Naturally Jim soon outdistances John. He flies until he meets Richard. Then he turns and flies back to meet John. He repeats this backward and forward journey in constantly shorter flights until finally he is crushed as John's and Richard's front tires come together in the center of the track, 10 miles from either end. The question is: What actual distance did the fly cover?"

"I don't see any sense," I said, "in attempting to work out a silly problem like that. Who cares, anyway?"

"So you give it up, eh?"

"I might as well. Certainly I have no intention of figuring here for hours and hours on a problem in which one of the factors constantly is changing as the bicycles draw closer together. Give me something definite to work on and I am your man, but trying to follow the vagaries of a horsefly—did you say it was a horsefly?—well, you can count me out."

"All of which goes to show that only one half of your brain is functioning at any given time. The problem is not one of distance but of time. Have I your ear? One will serve now. The bicycle riders traveled at a speed

Just another example of love's labor lost

of 10 miles per hour. Therefore they had been riding for exactly 1 hour when they met. Jimmy the Bo—horsefly to you—had a traveling speed of 15 miles per hour. Therefore he had traveled exactly 15 miles in that self same hour. Simple, eh? Only you did not happen to think of it.

"While on this subject of time I am reminded of an inquiry I had recently from a man who wanted to know what is considered the operating time of a cupola. Is it reckoned from the time it is patched in the morning, from the time the bed is made up, from the time it is lighted, from the time the blast is put on, or, from the time the first iron is tapped.

"In the generally accepted sense of the term the cupola is in operation from the time the blower starts until the bottom is dropped. This understanding is based on the common sense view that the cupola is a melting device and melting actually does not begin—in fact never would begin—until the large volume of air supplied by the blower raises the temperature of the coke sufficiently to melt the iron in contact with it.

"All the work preliminary to the blast-on stage may be classed as preparation, essential of course to securing the final result, but nevertheless only preparatory.

"The question presents some nice points for absolute decision, depending on the view point. From a purely academic view point, technical hair splitting might be carried on almost *ad infinitum*. For example, it might be claimed that every step in the preparation of the cupola is essential to successful operation, therefore the beginning of the operation lies in the first step. Again, it might be pointed out that since the cupola is a melting device, operation does not actually commence until the first iron trickles through the tap hole or falls into the well. Under another set of conditions—rather remote it is true, and shall we say decidedly improbable—the question of cupola labor hours might hinge on the 'time the cupola is in operation.'

"In this third instance, since the same crew is on duty all day, a literal interpretation of 'the time the cupola is in operation' will mean the entire working day. Any number of precedents may be cited to sustain this common sense interpretation. For example, the driver of a locomotive is regarded as being on duty for a given period irrespective of whether his engine is in motion or standing. So long as steam is up in the boiler the locomotive is regarded as potentially in operation.

"When you say of an individual that he attended school for 10 years, you have no intention of conveying the impression that he spent 24 hours per day, 365 days per year over a 10-year period in school. You know and your hearer knows as a result of universally known and well established habit and custom, that the individual to whom you refer began to attend school at a certain period and ceased attending 10 years later. The assumption is natural—although not necessarily correct—that he attended the usual 5 or 6-hour sessions, five days per week during the scholastic year for each of the 10 years.

"A man's life is reckoned from the day of his birth even though a well-known biological law and also the law of the land, take congnizance of an earlier period of existence.

"From the foregoing, typical of a wide range of instances familiar to every person it is apparent that a definition of the term 'operating time of a cupola' is subject to two interpretations. The first, technically accurate, and also familiar to every gray iron foundryman through years of usage and association, is that the 'operating time of a cupola' is confined to the time the blast is on. As stated previously this is based on the fact that after everything is in readiness the blast is put on and the operation of melting commences.

"Under the second interpretation the operating time of a cupola may be said to extend from the time a man enters it in the morning to chip and repair the lining, up to the time the bottom is dropped at the close of the day. Every item in the chain of perparation is necessary. If any one was omitted the cupola would not function."

Answers NRA Queries

(*Concluded from page 29*)

ceiving 10.1 per cent more compensation than during the previous year and only 13.4 per cent less than in the peak year of 1929. Based on reports from more than 2000 companies in 83 different industries, the durable goods committee reports that in February 1933, 44.3 per cent and in February 1934, 60.2 per cent of the total employed in July 1929 is shown to the credit of employment increase in these industries. The average earnings per hour in February 1934 were 96.9 per cent for unskilled workers and 94.6 per cent for skilled workers, in comparison with earnings in July 1929.

A shortage of skilled labor is reported in some industries and some localities and further improvement in business will become an active preventive of re-employment, due to the necessity of securing adequate skilled men to provide re-employment for a proportionate number of unskilled employes.

The inability of the durable goods manufacturers to absorb the additional cost of further increase in wages is shown by the fact that the total assets of all of the firms involved represent at the end of 1933 only 72 per cent of the total in 1929. The shrinkage of 28 per cent in total assets and 44.7 per cent in surpluses represented by cash receivables and inventories is a measure of the havoc wrought by the depression upon the durable goods industry.

Foundry Groups Report

Some interesting facts of direct import to the foundry industry are developed from the studies made by the four main branches of the industry and contributed as a part of the durable goods committee investigation. The gray iron foundry industry at present is operating at only 32.5 per cent of the 1929 volume, while assets have been depleted. However, 59.9 per cent of the 1929 personnel are now employed. A further decrease in hours, according to the gray iron code authority, would be ineffective under the present operating rate possible within the industry and beyond the control of the foundries by reason of the character of their work which depends entirely upon customers' orders. Further, exhausted resources make it impossible for manufacturers to meet increased costs without markedly increasing prices.

In the malleable industry a similar depletion of assets is reported. Here only 2 per cent of the products of the industry are manufactured for stock in continuous production and it is shown that by increasing wages 10 per cent and reducing hours 10 per cent, the direct increase in cost of malleable castings would be 16.3 per cent. A considerable shortage of skilled labor is reported and since the availability of skilled labor controls the total hours of employment for all classes, to further limit this factor would lead to unemployment rather than increased employment.

In the nonferrous branch of the industry a study shows that labor is divided as follows: 20 per cent skilled, 60 per cent semiskilled and only 20 per cent common labor. The dearth of properly trained men already has become apparent in many localities and in fact the nonferrous industry holds that there is little unemployment in either the skilled or semiskilled classifications in that industry. For this reason a further decrease in hours below the present code average is protested.

Production Has Dropped

An interesting development of the study of labor conditions in the nonferrous industry shows that in 1929 the production per man hour averaged between 11 and 12 pounds of castings, while in 1932 this had dropped to 8.5 pounds. The spread between average cost of metals and average sales price per pound likewise has steadily decreased until now with an average production of 8.5 pounds per man hour, less than ½ cent per pound margin over metal and labor is left to the foundry to cover all operating expenses for materials, supplies, etc. It is estimated that a 10 per cent decrease in hours per week below the code average will decrease production per man hour from 10 to 15 per cent and an increase in man hour cost of 10 per cent will make a net increase in payroll per pound of castings of 25 to 30 per cent.

A complete and detailed study of 12 points presented by the administration is contained in the report of the Steel Founders' society. It is shown that with a 10 per cent reduction in working hours per employe necessitating the use of more men to get out the same work and with a 10 per cent increase in average hourly wage rates, now at $0.534 per hour, the payroll increase for the total production of the industry would amount to 25 per cent. Since the payroll represents 50 per cent of the cost of producing castings the total cost directly due to the decrease in hours and increase in wages would be 12½ per cent. If the same proportionate increase were applied to all basic materials entering into steel castings, the result would be an addition of 20 to 25 per cent in cost. It is believed that increased prices would materially curtail volumes of sales and would produce a repercussion leading to unemployment.

Here as in other branches of industry represented under the durable goods classification, the shortage of skilled labor is a limiting factor since from 75 to 90 per cent of the industry's employes are skilled or semi-skilled.

A further point emphasized in relation to basic commodities such as castings is the danger of limiting through restrictive measures the production of commodities which would further retard manufacturers at other points further along the line of production. This limitation would definitely retard employment because of delayed delivery of equipment and supplies.

It is shown conclusively in this detailed study of the durable goods industries that the depression has taken heavy toll of capital assets, has depleted working funds and without some measures to provide credit, the industries concerned are confronted by an insurmountable obstacle. Another point stressed in all of the reports is the dearth of skilled men due to the lack of employment and training, through apprenticeship or otherwise, and the depletion of age, incapacitation or transfer to other pursuits. Truly, the foundry industry in common with many other capital goods industries must replace its "lost battalion."

New England Club Hears Talk on Patterns

W. S. Thomson, general foreman, pattern department, General Electric Co., Lynn, Mass., addressed the regular meeting of the New England Foundrymen's association on April 11 at the Engineers' Club, Boston. Mr. Thomson spoke on "Pattern Planning and Equipment for the Foundry for Economical Production of Castings."

Cast Iron Subject of Institute Paper

Annual meeting of the British Iron and Steel institute will be held on Thursday and Friday, May 31 and June 1, at the Institution of Civil Engineers, Westminster, London. Included in the papers is one by J. G. Pearce on "Elasticity, Deflection and Resilience of Cast Iron."

Malleable Chain Manufacturer's institute has moved from 4603 Beacon street, to Room 1627, 11 South LaSalle street, Chicago. M. L. Patterson is executive secretary.

GAGGERS OF TWISTED STEEL

Franklin twisted steel gaggers overcome "drop-outs" and on account of their distinctive twist are readily recognized and separated from scrap.

The spiral twist permits the use of much smaller gaggers and at the same time provides more than four times the grip on the sand when compared with a larger size deformed bar gagger.

We are also manufacturers of twisted tempered steel tumbling barrel stars.

For sale by all foundry supply houses.

FRANKLIN

Trade Mark Reg. U. S. Pat. Off. Patent No. 1862216

Twisted Steel **GAGGERS** — Four times more grip than other gaggers! Sizes: 1/4"-5/16"-3/8"-1/2"-5/8".

Core Rod & Gagger Co. Franklin, Pa.

Tempered Twisted **STARS** — Eight points!—Twelve cleaning edges!—Long life! Sizes: 3/4"-1"-1 1/2"-2"-3 1/2".

UNIFORM in size
PERFECT in shape
EXTREMELY HARD
PERFECTED by experience.

American "Standardized" Steel Shot and "Eversharp" Steel Grit represent Steel Abrasives at their best. Cheaper in the long run because they last longer and do better work than any less perfect product.

This ton of American Steel Abrasives will do the work of a carload of sand. Big savings in freight, in storage, in handling and in waste removal.

You can SEE the difference and use will soon PROVE the difference.

Write for samples and prices on this better product.

THE AMERICAN STEEL ABRASIVES CO.
Galion, Ohio

Greater Efficiency Increased Capacity of CURTIS Model C Compressor

Carbon-Free Valves

Cooled Air Intake

Timken Bearings

Centro-Ring Oiling

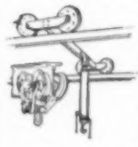
ADDITIONAL capacity with no increase in size is a feature of the new Curtis Model C Compressor. Greater efficiency is obtained with new type head equipped with large area short intake passages; oversize ports; straight line air flow; and cooled air intake. The air enters the cylinder at a low temperature. Both peak pressure and temperature of compression are decreased. Excessive head cooling is avoided, evaporation of oil from piston and cylinder walls, and precipitation of carbon is reduced.

Centro-Ring Oiling provides positive lubrication; while Timken Bearings assure reduced friction, longer life and make adjustments easy.

Because of the increased capacity, the cost of the air is relatively lower.

An illustrated folder gives full details. Write

CURTIS I-BEAM CRANES AND TROLLEYS



Large wheels, roller bearings — unusually easy-running.

CURTIS AIR HOISTS

Cost no more than chain block. Simple; laborer can handle. Abuse-proof — no repair delays. One-half to ten-ton capacity.

CURTIS PNEUMATIC MACHINERY CO.
1922 Kienlen Avenue, St. Louis, Missouri
5518T Hudson Terminal, New York City

CURTIS

COMPRESSORS—AIR HOISTS
I-BEAM CRANES AND TROLLEYS

Desulphurizing with Soda Ash

(*Continued from page 27*)

the refining upon the metal.

$Na_2CO_3 + FeS \longleftrightarrow Na_2S + FeO + CO_2$

$CO_2 + Fe \longleftrightarrow FeO + CO$

$Na_2S + 2FeO + FeO.SiO_2 \longleftrightarrow Na_2SiO_2 + SO_2 + 3Fe$

$Na_2O + 2FeO + FeSi \longleftrightarrow Na_2SiO_3 + 3Fe$

At first, oxides and gases resulting in the initial reactions are diffused throughout the metal bath. This causes a violent boiling action which continually brings new metal into contact with the soda slag. The oxides gradually are reduced by subsequent reactions and entrained silicious slags are converted into more liquid soda slags. The fused soda ash slags thus formed are more mobile and with entrapped gases gradually are forced upward into the slag bath. This is indicated by the fact that a casting poured immediately after treatment will show a profusion of blowholes and slag inclusions. Where ample time is allowed for completion of the reaction cycle, the boiling and escape of entrapped gas, the same iron will lie quietly in the ladle and the resulting casting will show a clean, dense structure. Naturally the reactions are more rapid at high temperatures. Elapsed time required for completion of the process ranges from 3 to 15 or even 20 minutes. The time varies with temperature and depth of volume of metal.

The foregoing explains the importance of head pressure in the bath for forcing the impurities upward, out of the metal and into the refining slag. Also the importance of regulating the desulphurizing process to allow ample time for completion of the refining reactions before the metal reaches the pouring ladle. These two important features frequently have been overlooked by inexperienced foundrymen in their experiments with soda ash.

Result of the refining action upon the graphite structure and in the removal of nonmetallic inclusions clearly is shown in the accompanying micrographs. As might be expected, the effect is more pronounced and noticeable with high scrap mixtures. The tendency is toward breaking up or dispersing the graphite. In practical foundry parlance "To produce a more uniformly fine grain structure." Under certain conditions the treatment may cause an increase in the size of the graphite flakes. For example, a highly oxidized iron, or an iron high in sulphur which normally would freeze or set quickly, would result in high combined carbon and fine graphite flakes. Lowering the freezing point on this iron as might be indicated by an increase in fluidity would allow more time for graphitization and result thereby in the formation of larger crystals.

The accompanying micrographs, 100 diameters unetched, illustrate the most general effect of refining upon the structure of cast iron. Fig. 1 from a soft, high scrap mixture represents a rather extreme case. The hard all scrap mixture shown in Fig. 2 indicates more nearly the degree of refinement expected in normal operation.

Fifty years ago the use of limestone in the cupola was the exception rather than the rule. Today scarcely a doubt exists as to its value as an aid to better melting practice. During the past 10 years an ever increasing number of foundrymen have discovered that the addition of small amounts of fused soda ash to the limestone charge marks another forward step in the advancement of cupola practice. The reason for this change is shown in Table II, a comparison of the properties of calcium carbonate (limestone) and sodium carbonate (fused soda ash) and their action in the cupola.

The most important contribution of fused soda ash in the cupola is the effect on combustion. Soda ash liquefies the slag and then accelerates the combustion reactions by catalytic action. Effect of fused soda ash in reducing the pickup of sulphur by the iron during the melting period, and further effect in preventing oxidation, no doubt is due more to improvement in combustion than to direct action of the soda slag on the metal.

Catalytic action of sodium carbonate in accelerating combustion reactions of carbon, clearly was demonstrated in the research work of David A. Fox and Alfred H. White, University of Michigan, as published in *Industrial and Engineering Chemistry*, March, 1931 under the title "Effect of Sodium Carbonate upon Gasification of Carbon and Production of Producer Gas."

In connection with the action of sodium carbonate upon combustion in the cupola as illustrated in Fig. 3, the following comment by Mr. Fox is pertinent and interesting:

"The zones marked maximum temperature zone, oxidizing zone and combustion zone are typical of normal operation. By adding sodium carbonate these zones possibly might be limited to an annular shape lying close to the tuyeres. This results from the rapid rate of reduction of carbon dioxide (CO_2) which occurs when the fuel is treated with sodium carbonate. The rate of reduction of carbon dioxide being much greater, the reduction takes place within short range of the oxidizing zone. The reduction being highly endothermic, heat is extracted from the exothermic oxidizing zone at a high rate, restricting the high temperature regions to the near vicinity of the tuyeres. When no sodium carbonate is present and the reduction of carbon dioxide is more gradual, the oxidizing zone or maximum temperature zone spreads to a considerable extent.

The revised diagram indicates that a core or chimney exists in the center of the cupola through which melted metal may drop without ever coming in contact with an atmosphere containing oxygen or carbon dioxide. As a matter of fact, most of the melted metal probably will drop through this core, due to the converging nature of the principle lines of flow of the blast.

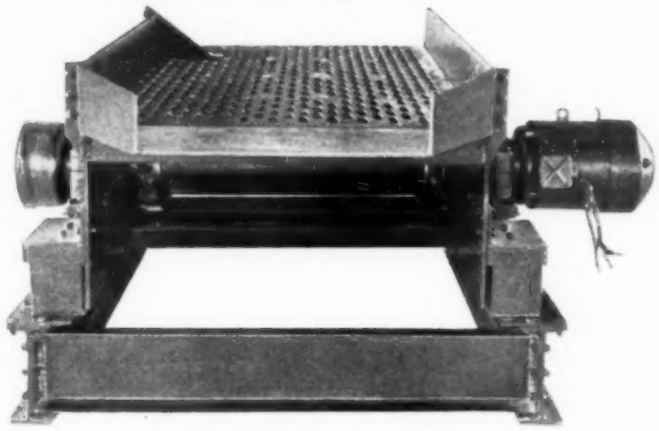
Although not actually dealing with cupola combustion, the research work of Messrs. Fox and White present a basis for a line of reasoning by which it is possible to explain certain effects of small quantities of fused soda ash in the cupola which would not seem possible solely as a result of the action in liquifying and increasing the fluxing power of the slag. For example, the effect in keeping the tuyeres bright and in preventing bridging over the tuyeres throughout long heats, is explainable in part by the action of the sodium carbonate in accelerating combustion and thereby restricting

(*Concluded on page 64*)

Reduce Sulphur

DEVELOPMENT of the use of fused soda ash in the gray iron foundry has progressed along three general lines: Treatment of the molten metal after it leaves the cupola, additions to the cupola charge, and duplexing or desulphurizing metal between the cupola and the refining furnace. In common with many phases of foundry practice, present use of sodium carbonate or fused soda ash, known under the commercial name Purite, has developed principally through a process of trial and error. The material was introduced primarily as a desulphurizing agent to lower mixture costs and improve melting conditions in the cupola. Later it was found that the treatment improved the structure, machinability and quality of the finished castings. The accompanying article is from a paper presented by George S. Evans, before the Quad-City Foundrymens association, Moline, Ill., Feb. 19, 1934.

Simplicity Shake-Out Screens



are
Producing Cleaner Castings
with
Resultant Sand Saving
at
Lower Operating Costs
because
Maintenance Expense is Reduced to a Minimum

Continuous service under severe conditions in Production Foundries with these results are bringing Repeat Orders. Of equal value in the reduction of foundry costs are the Simplicity Gyrating Screens for cleaning moulding sand through 1/8", and the Simplicity Conveyor for Hot Castings. Each Simplicity Unit is designed and built to meet conditions in your own plant; with satisfactory operation guaranteed.

Manufactured and sold by

Simplicity Engineering Company

Durand, Michigan

For Canada: Waterous Limited, Brantford, Ontario

Hotel Sinton Cincinnati

Greatest Hotel Value in **CINCINNATI**

700 ROOMS WITH BATH AND SERVIDOR
$2.00 PER DAY AND UP
•
$1.00 PER DAY EXTRA FOR ADDITIONAL OCCUPANT OF ROOM

A minute from everywhere... All bedrooms and suites modernized. ..Headquarters for the exclusive Town Club and Racquet Club.... A vital part of Cincinnati's polite Social Life...Successor to Cincinnati's famous old St. Nicholas Hotel...The city's Quality Hotel.

Finest of Fine Foods
Dining Rooms ..Cafeteria Lunch Room ..Coffee Shop and the renowned Sinton Cocktail Cafe reborn.

75 MODERN SAMPLE ROOMS WITH BATH OR SHOWER AT $2.50 TO $5 PER DAY

HOTEL SINTON ST. NICHOLAS

HANNA PIG IRON

—dependable uniformity

BRANDS:
Buffalo—Detroit—Susquehanna
•
GRADES:
Foundry—Malleable
Silvery — Ferro-Silicon
•

The HANNA FURNACE CORP.

MERCHANT PIG IRON DIVISION
OF NATIONAL STEEL CORP.
Buffalo New York
New York Philadelphia Detroit, Mich.
Boston

(*Concluded from page* 62)

the zone of maximum temperature more nearly to the region of the tuyeres.

In many instances with the cupola melting at a low temperature, the addition of 2 poounds of fused soda ash per ton in the charge has resulted in an appreciable increase in temperature and in the fluidity of the slag. Here again apparently the action of sodium in accelerating combustion is of relatively greater importance than any direct effect of a small amount upon the slag. Increase of slag fluidity from a trifling addition of soda ash is the result of temperature rather rather than the direct effect of soda ash in lowering the fusing point.

This assumption would seem to explain the increased burning away of the lining just above the tuyeres, usually noted in cupolas melting on the cold side. Cutting is due to higher temperatures—melting point of the average cupola block is about 3100 degrees Fahr.—rather than to direct chemical action of the soda slag upon the lining.

Catalytic action of sodium carbonate in the reduction of iron oxide was described by G. C. Williams and R. A. Rogatz, University of Wisconsin, in "Effect of Sodium Carbonate on Low Temperature Reduction of Iron Ores," published in *Industrial Engineering Chemistry*, December, 1932. They found that additions of sodium carbonate to mixtures of ground coke and iron ore greatly accelerated the rate of reduction.

At a temperature of molten iron (2500-2800 degrees Fahr.) the effect would be more pronounced. As a matter of fact, sodium carbonate is disassociated into nascent sodium (a powerful deoxidizing agent) in the presence of carbon at a temperature of about 2200 degrees Fahr.

From the foregoing it is apparent that the effect upon combustion and upon the fluidity of the slag is proportionally less noticeable in hot melting cupolas. However, in considering the effect in cupolas operating at lower temperatures, it seems reasonable to expect a profitable return under all conditions of cupola practice, even though the effects always are not discernible to the naked eye.

During the past 10 years many gray iron foundries have found that it is possible to increase the scrap content in the cupola charge by at least 10 per cent where 4 pounds of fused soda ash is added per ton of iron and where the silicon and manganese are adjusted to compensate for any loss. The resulting iron has shown no increase in sulphur at the spout or hardness in the finished castings.

The desulphurizing process is carried out more satisfactorily in a forehearth or ladle than in the cupola. The prime value of soda ash in the cupola results from the action in improving combustion and increasing the activity of the lime slag. One pound of soda ash to each 10 pounds of limestone may be expected to reduce the sulphur content approximately 1.5 points, or from 0.10 to 0.085 per cent. Reduction of 3 points can be obtained fairly regularly on high sulphur iron, but correspondingly lower reduction may be expected on low sulphur iron. It is possible to effect greater reductions in the cupola with careful control of the sand and dirt going in with the charge and by using larger quantities, but it is difficult to obtain uniform results from day to day, therefore, the practice is not recommended.

In malleable foundries soda ash is used for duplexing cupola metal and as a direct addition to the air furnace charge. It is used in the melting and refining operations for brass and copper. It is also used extensively in the steel industry.

Pittsburgh Group Hears Talk on Steel

The April meeting of Pittsburgh Foundrymen's association was held at the Mayfair hotel, Pittsburgh, Monday evening, April 16. About 80 were present to listen to Maj. R. A. Bull, Chicago, who spoke on "Steel Castings — Practice and Theory." Major Bull called particular attention to the fact that even though the production of steel castings has been at a very low point during past few years, nevertheless steel foundry developments have kept pace with industry's needs. He mentioned the fact that there are practically 80 different analyses of alloy cast steels and that this large number must, in time, be reduced. The talk was illustrated with interesting slides. Frank J. Lanahan of the Ft. Pitt Malleable Iron Co., Pittsburgh, and president of the American Foundrymen's association, introduced Major Bull.

Speaker for the next meeting to be held May 21, will be W. T. Sheffield, Hershey Machine & Foundry Co., Manheim, Pa., who will talk on "Internal Shrinkage in Gray Cast Iron."

Discusses Alloying Of Iron with Chromium

D. B. Reeder, metallurgist, Electro Metallurgical Co., Pittsburgh, addressed members of the Philadelphia Foundrymen's association at the regular meeting held April 11 in the Broadwood hotel, Philadelphia. Mr. Reeder spoke on "Use of Chromium in Cast Iron." C. Walter Yost, Reading Iron Co., Reading, Pa., president of the association, presided.

Organizes Code Authority for Gray Iron

Code authority of the gray iron foundry industry recently was completed with the election of two representatives of nonmembers of the Gray Iron Founders' society. The board consists of six representatives chosen from the board of directors of the society, and two from representatives of nonmembers. The representatives of the industry are as follows:

G. D. Branston, assistant secretary and treasurer, Campbell Wyant & Cannon Foundry Co., Muskegon, Mich.; F. R. Hoadley, vice president, Farrel-Birmingham Co., Inc., Ansonia, Conn.; C. B. Magrath, president, North Western Foundry Co., Chicago; George M. Morrow, president, Goslin-Birmingham Mfg. Co., Birmingham, Ala.; B. R. Pearse, secretary and treasurer, Atlas Foundry Co., Cleveland; A. B. Root Jr., assistant general manager, Hunt-Spiller Mfg. Corp., Boston; William Taylor, president, Taylor & Co., Brooklyn, N. Y.; and W. H. Winters, general superintendent of foundries, American Brake Shoe & Foundry Co., New York. W. C. Connelly, for many years president of the D. Connelly Boiler Co., Cleveland is administration representative.

The code authority recently met and elected the following officers: Chairman, F. R. Hoadley; vice chairman, C. B. Magrath; executive vice president for the code authority, H. M. Halsted Jr. The Gray Iron Founders' Society, Public Square building, Cleveland, was designated as the administrative agency for the gray iron code.

Made Vice President

Albert S. Low has been made vice president and chief engineer of the Austin Co., Cleveland, succeeding Harry E. Stitt, who will continue his association with the company as consulting engineer. Mr. Low has been with the Austin Co. for 21 years and has been active in the various branches of its work. During the past 12 years he has been in charge of the central district as regional vice president with headquarters in Chicago. He is a graduate of Sheffield Scientific School, Yale university.

Peter C. McCabe will succeed Mr. Low as acting district manager in charge of the Chicago office of the Austin company.

Changes Firm Name

Pennsylvania Lubricating Co., 34th and Smallman streets, Pittsburgh, has changed its name to Penola, Inc.

ADVERTISING PAGES OMITTED

European Foundry Practice

Digest of recent literature covering various phases of castings manufacture

Molding Sand

Influence of the Nature of Molding Sands on the Strength of Metals and Alloys, by Ing. Dr. H. Lepp, exchange paper of the Dutch Foundry association presented at the foundry congress in Prague.

Tests have shown that it is the steam, which by the reaction $H_2O + M_e = M_eO + H_2$, is the cause of the formation of oxides and gases which are absorbed at given pressures and temperatures, and this reduces the mechanical properties of metals and their alloys. As a result, a serious control of molding sand is indispensable to obtain good quality castings. The control of molding sands by the laboratory should be extended to the works and should include the checking of the finished mold. To facilitate and simplify such control, it is advisable to prepare for each kind of sand a diagram in the manner indicated in the paper and which relates to the permeability and the critical humidity of the sands for each alloy or group of alloys. Once these diagrams are known, it is easy to ascertain the possibilities of using sands for certain given alloys. It is also necessary to determine the relation between the permeability and the tightness of the sand of the mold, especially with regard to green sands.

Foundry Defects

Study of Foundry Defects (Etude des Defauts de Fonderie), by E. V. Ronceray, *La Revue de Fonderie Moderne*, Paris, Dec. 10, 1933.

A matter of considerable importance to defects in castings is the action of gases, which arise from the contact of the hot metal with the mold. Another source is gases which are included in the molten metal. Means must be taken to allow the gases to disperse without unduly disturbing the metal or the mold. It is for that reason that permeability is one of the most important characteristics of molding sands. It is also to avoid the detrimental effect of gases that molds are dried and that special precautions are taken in making and drying cores to allow gases to escape.

Gases also escape through the metal, and at the time when the metal begins to solidify, this escape of gas generally causes a defect in the casting which often takes the form of a cavity in the upper or lower part. In some cases the cavity is closed and hidden by a skin of metal. To avoid this defect it is necessary that the mold be sufficiently permeable and that the pressure of the metal be sufficiently high.

In certain cases these defects occur in angles or in narrow sections which have been subjected to considerable heat. These particular defects have been specially studied by Mr. Leonard and subsequently by Mr. Ronceray, who has given to them the name of Leonard effect. These defects should not be confused with piping, and cannot be remedied by the same means. It is not heads or risers that will correct them, but permeability.

Scabs usually are caused by gases displacing sand from the mold, owing to insufficient permeability or to exaggerated ramming. The best way to avoid scabs is to use a permeable sand, not ram the facing sand too hard, specially with a small tool, and to provide air vents.

Defects also occur through air being drawn in by the metal while it is being poured, especially if the metal is cold. This often is accompanied by a chemical action of the air on one of the constituents of the metal. The author has termed this the Custer effect, because it was studied by Custer in America.

A number of defects are due to piping. To avoid this, great care should be taken in establishing runners, heads, and risers. It is also possible, in some cases, to use chills in certain parts of the mold. The method of pouring has a bearing on this defect, and bottom pouring increases the tendency to piping. Other factors to consider are the pouring temperature and the rate of pouring.

Dissolved gases and gas inclusions cause pinholes and blowholes, and they occur mostly in nonferrous metals. Contraction causes internal stresses and cracks; these defects occur mostly where there are thin and wide sections in juxtaposition. To avoid contraction defects, it is usual to pour through the thin sections and keep the metal hot, but each case should be treated according to its merits.

Oil Fired Cupola

Investigation with Additional Crude Oil Firing in the Cupola (Versuche mit Naphthazusatzfeuerung an Kupoloefen), by Wilhelm Schneider, *Die Giesserei*, Duesseldorf, March 2, 1934.

The author presents some data on the application of supplementary oil-firing on a cupola in addition to coke. The cupola had a diameter of 31 inches, and was employed in the production of both blackheart and whiteheart cupola malleable. The coke used contained from 2.5 to 3.6 per cent sulphur, and it was decided to try supplementary oil-firing to reduce the amount of coke used between charges, and subsequently the sulphur content of the iron.

Before the oil-firing installation the iron charges weighed 325 kilograms (715 pounds) and the coke splits 78 kilograms (172 pounds), and the melting rate was 3500 kilograms (7700 pounds) per hour. With oil firing the charges were increased to 450 kilograms (990 pounds), the coke splits reduced to 67.5 kilograms (148.5 pounds) and the melting rate increased to 5500 kilograms (12,100 pounds) per hour. The amount of oil used ranged from 0.8 to 1.0 kilogram (1.76 to 2.2 pounds) per 100 kilograms (220 pounds) of liquid iron. With coke at 30 R. M. ($7.14) per ton and oil at 60 R. M. ($14.28) per ton, the cost per 100 kilograms (220 pounds) of liquid iron with straight coke firing was estimated at 0.861 R. M. ($0.2049), while with oil and coke firing the cost was 0.651 R. M. ($0.1549) for fuels only. In addition to saving in melting cost the sulphur in the iron was reduced from 0.28 per cent to 0.19 to 0.20 per cent, and the annealing time required for the white iron was reduced from 208 to 136 hours.

Obituary

SAMUEL T. JOHNSTON, 67, president of the Standard Sand & Machine Co., Chicago, a former president of the American Foundrymen's association, and one of the most widely known and highly respected men in the foundry industry, died at his home in Riverside, a suburb of Chicago, April 23, following a heart attack. With a background of 45 years in the foundry industry, first in connection with plant operation

Samuel T. Johnston

and then in the sale of foundry equipment and supplies and through years of service in various foundrymen's association, he enjoyed an exceptionally wide acquaintance among foundrymen, and equipment and supply manufacturers.

Mr. Johnston was born in Glasgow, Scotland, June 2, 1866, and was educated in the schools of his native city. In 1889 he came to this country, his first connection being with the Detroit Car Wheel Co., Detroit, of which J. H. Whiting was superintendent. Later when Mr. Whiting organized the Detroit Foundry Equipment Co., Mr. Johnston was given a position as salesman. Ten years later he left that position to become connected with the S. Obermayer Co., Chicago, where he occupied various executive capacities, and in 1932 retired as vice president of that company.

Early in his association with the foundry industry he became identified with organizations in the field and in 1896 was elected secretary of the Western Foundrymen's association. As an officer of that group he was one of the signers of the call for the organization meeting of the American Foundrymen's association and since had attended every annual meeting of that association. He was elected the first president of the Foundry Supply association when it was formed in 1906, and served as vice president of the A. F. A. in 1908 and 1909. In 1927 and 1928 he again served as vice president and in 1929 was elected president. In his capacity as president he led a group of American foundrymen attending the third International Foundrymen's congress in London, June, 1929.

Several weeks ago Mr. Johnston was called to Washington where he was offered and accepted appointment as government representative on the code authorities of two industries and shortly was to have served on three or four others.

♦ ♦ ♦

Clement A. Hardy, 80, formerly sales manager for the Whiting Corp., Harvey, Ill., and well known in the foundry industry as a consulting engineer, died April 15 at his home in Chicago. He left Whiting Corp. in 1918 to form his own consulting company but rejoined the Whiting Corp. several years later to do special sales work. He retired in 1932.

♦ ♦ ♦

Alfred J. Jupp, vice president, Lunkenheimer Co., Cincinnati, died in New York April 10, on a business trip. Mr. Jupp was born in Cincinnati in 1875 and entered the employ of the Lunkenheimer Co. in 1890. In 1896 he was made New York representative, returning to the home office in Cincinnati in 1913. He was active in the Manufacturers' Standardization society and also contributed the greater part of his time during recent months to code work in the valve and fittings industry.

♦ ♦ ♦

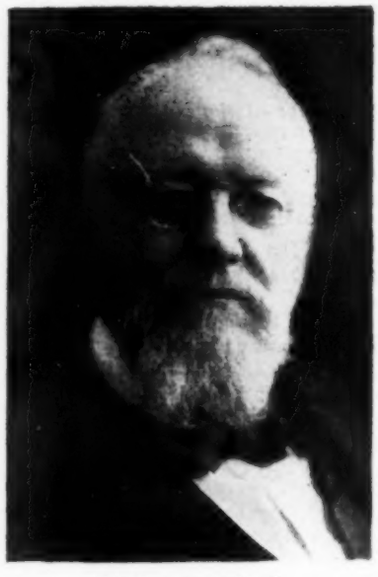
William C. Cadwallader, 48, for 11 years works manager, Eastern Steel Castings, Newark, N. J., died at St. Michaels hospital, that city April 1. Born at Chester, Pa., Mr. Cadwallader, previous to his connection with the Eastern Steel Castings plant, had been with American Steel Foundries, Thurlow plant, Chester, Pa., Otis Steel Co., Cleveland, and Reading Steel Casting Co., Reading, Pa.

♦ ♦ ♦

Adolphe S. Deutsch, 81, president, Monarch Aluminum Ware Co., Cleveland, died recently in Rochester. Mr. Deutsch was a veteran in the Cleveland metal products industry but moved to Rochester several years ago, though continuing active in the business of the Monarch Co. A number of years ago he came to Cleveland and entered the metal products business under the firm of A. S. Deutsch & Co., which was succeeded by the Monarch Brass Co., later by the Republic Brass Co., and then by the Monarch Aluminum Ware Co.

♦ ♦ ♦

Walter D. Wood, 84, president of R. D. Wood & Co., Philadelphia, and owner of the Florence Pipe & Foundry Co., Florence, N. J., died in Washington April 20 following a brief illness. Mr. Wood was long identified with the foundry industry and was the last of three brothers to succeed



Walter D. Wood

to the leadership of the Wood company which was founded by the father, Richard D. Wood. He was born in Philadelphia and was graduated from Haverford college in 1867 with the degree of bachelor of arts. He then took 2 years of graduate study at Harvard university whereupon he became affiliated with his father's company.

As head of the R. D. Wood Co. for 63 years he was not only well known in this country but maintained an acquaintanceship with foundry leaders in various sections of the world. He was one of the charter members of the American Foundrymen's association and until recent years was active in the technical deliberations of that organization. He was also a member of the American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, the American Society for Metals, the American Society for Testing Materials, and the American Waterworks association.

His business interests were extensive and varied. In addition to those already mentioned he was the owner of the Millville, N. J., *Daily Republican*, and was owner and treasurer of the Cumberland County Gas Co.,

(*Concluded on page* 70)

THREE MILES PER MINUTE

AS the speedometer crawls upward do you sometimes wonder how the many moving parts withstand the increasing strain? Your crankshaft, for instance, must be ground with utmost accuracy, its finish must be perfect and it must be done in the course of high production. It must withstand the speed.

For years STERLING Crankshaft Wheels have been doing just this in automobile plants and in addition many other equally important parts are ground to accuracy and high finish with high production STERLING Wheels. There is a STERLING high production wheel or your grinding operation, too.

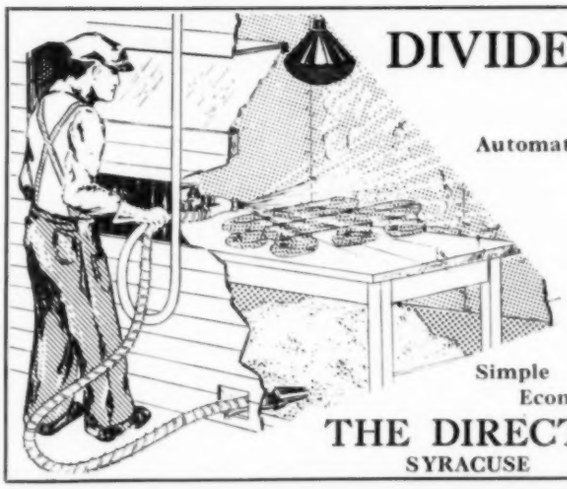
THE STERLING GRINDING WHEEL COMPANY

Abrasive Division of The Cleveland Quarries Co.

Factory and Office
TIFFIN, OHIO

CHICAGO: 133 N. Wacker Drive
DETROIT: 5191 Lorraine Ave.

STERLING CLEVELAND TRADE MARK ABRASIVES



DIVIDE AIR SEPARATORS

For removing oil and water
from compressed air

Automatically Drained — Very Efficient

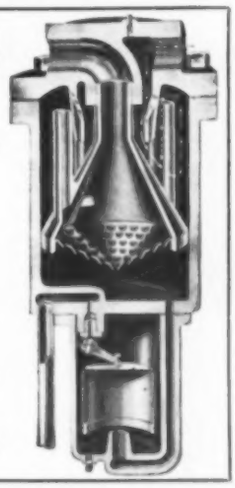
* * * *

CYCLONE BLASTERS

For cleaning Castings and Steel
(use Sand, Grit or Shot)

Simple — Efficient — Inexpensive

Economical to operate — Results Guaranteed



THE DIRECT SEPARATOR CO., INC.

SYRACUSE — NEW YORK

Sole Manufacturers of

PAXSON FOUNDRY EQUIPMENT

formerly built and sold by J. W. Paxson Co.
and the Titgen-Eastwood Co.

We have the complete PAXSON patterns and
are prepared to furnish repair parts promptly.

NRA WE DO OUR PART

THE TABOR MANUFACTURING COMPANY
6225 TACONY ST., PHILADELPHIA—PENNA.

(*Concluded from page* 68)

the Millville Electric Light Co., the Millville Water Co., and the High Pressure Construction Co. He was a member of the Philadelphia Bourse and from 1880 to 1884 was a member of the Philadelphia Committee of 100, and from 1887 to 1895 was civil service examiner in Philadelphia. He also was trustee of Haverford college.

♦ ♦ ♦

E. H. Bruner, 61, secretary, Chicago Wheel & Mfg. Co., Chicago, died recently.

♦ ♦ ♦

Luther L. Knox, 63, one of the founders of the Blaw-Knox Co., Blawnox, Pa., died recently at his home in Bellevue, Pa.

♦ ♦ ♦

Jacob D. Utech, 65, an instructor in foundry practice at Carnegie Institute of Technology, Pittsburgh, since 1915, died at Pittsburgh, April 11.

♦ ♦ ♦

Thomas V. Scott, director, Graff Co., Pittsburgh, and secretary and treasurer, Pittsburgh & Mt. Shasta Mining Corp., died in Bandsburg, Calif. recently.

♦ ♦ ♦

Henry A. Butler, 61, son of the late Joseph G. Butler Jr., and prominently identified with various industrial concerns in the Mahoning valley, died recently. He was a director of the Industrial Silica Co., producer of foundry sand.

♦ ♦ ♦

James Orr Callaghan, 77, died recently at his home in Hamilton, Ont. Mr. Callaghan started his career at the age of 11, with Ives & Allan Foundry, Montreal, later going to Pillow & Hersey Foundry, Montreal. In 1888 he went to Hamilton where he joined the Steel Co. of Canada, and retired from that company in 1923.

♦ ♦ ♦

Harry H. Barclay, 69, president of the Beryk Co., Cleveland, manufacturer of foundry vibrators and other foundry supplies, died recently at his home in Lakewood, O., after six months' illness. Born in Buffalo, he removed to Cleveland 35 years ago, and has been identified with the foundry equipment industry for many years.

♦ ♦ ♦

Edward W. Murphy, 67, owner of the Northampton Iron Works, Northampton, Mass., died recently. Mr. Murphy was a native of Northampton and had worked in the foundry industry since he was 15 years old. For 27 years he was employed by the Norwood Engineering Co. Inc., Florence, and for 15 years was foreman of the foundry. He operated the Northampton Iron Works from 1918 until he sold the business in 1923, but repurchased the foundry last June.

Chicago Founders Discuss Maintenance

Plant maintenance was the topic for discussion at the monthly meeting of the Chicago Foundrymen's club, held April 5 at the Great Northern hotel. About 60 members and guests attended. Principal speakers were James Thomson, chief engineer, Continental Roll & Steel Foundry Co., East Chicago, Ind., and L. H. Hopkins, assistant works manager, McCormick works, International Harvester Co., Chicago.

Tracing the increase in importance of maintenance work, Mr. Thomson described the principal functions of the maintenance department in both preventive and corrective practices. While some small companies without a plant engineer avail themselves of consulting engineers in connection with their major problems, the speaker recommended that the consultant be a foundry engineer and not a general consulting engineer. The foundry that cannot afford a plant engineer should have a high-class, experienced foundry master mechanic, he suggested.

Mr. Thomson presented charts to illustrate an organization setup for both large and small foundries. In any foundry it is advisable to have the functions of the various departments clearly defined, he pointed out. Describing freedom from emergency repairs as one measure of the efficiency of the maintenance department, redesign of machines was suggested as one method of preventing breakdowns. Well-planned inspection of equipment is an important function of the maintenance department, and Mr. Thomson discussed several forms for keeping records of plant facilities and their inspection. Standardization of materials and equipment was recommended to the extent of the widest interchangeability of parts consistent with greatest usefullness of equipment and improvement in design.

Mr. Thomson stated that there is room for improvement in the design of foundry equipment, particularly that used by the steel foundry. Questions of lubrication, dust-proofing, materials, etc. in various cases have not been answered properly and in certain instances steel foundries have built part of their own equipment. Part of this trouble he ascribed to the varying requirements of different branches of the foundry industry.

Mr. Hopkins discussed specific maintenance problems encountered in the foundry, recommending corrective measures for such instances.

At a special meeting of the Chicago Foundrymen's club, held April 23, the organization voted to petition the American Foundrymen's association for the establishment of the Chicago section, American Foundrymen's association. The Chicago group is the first to seek this affiliation.

Foundry Sands Represented on Code

Full provision now has been effected to care for the foundry sand industry under the code of the crushed stone, sand and gravel, and slag industry. Foundry sand producers are represented in the code authority's divisional committee on industrial sands, which has a chairman and six vice chairmen. A. Warsaw, Wedron Silica Co., 38 South Dearborn street, Chicago, is chairman; Mark McKee, Sand Products Corp., Detroit, is vice chairman for foundry sands, unbonded, and A. J. Miller, Whitehead Bros. Co., 537 West twenty-seventh street, New York, is vice chairman for foundry sands, bonded.

Under this industrial sands divisional committee are 16 regional industrial sands committees covering all parts of the country, and organized to administer the code in accordance with local conditions. Problems of foundry sand producers may be filed with these regional committees, which, if necessary, will refer them to the code authority which, in turn, if necessary, will consult with the proper vice chairman of the divisional committee on industrial sands. The code authority has its headquarters in the Munsey building, Washington.

Attendance Good At Connecticut Meetings

William Kelly, Nassau Smelting & Refining Co., division of Western Electric Co., addressed the meeting of the Connecticut Nonferrous Foundrymen's association held April 10 at the Hotel Garde, New Haven, Conn. Mr. Kelly spoke on "Manufacture and Use of Composition Ingots" and was assisted in the discussion by Walter H. Jacobson.

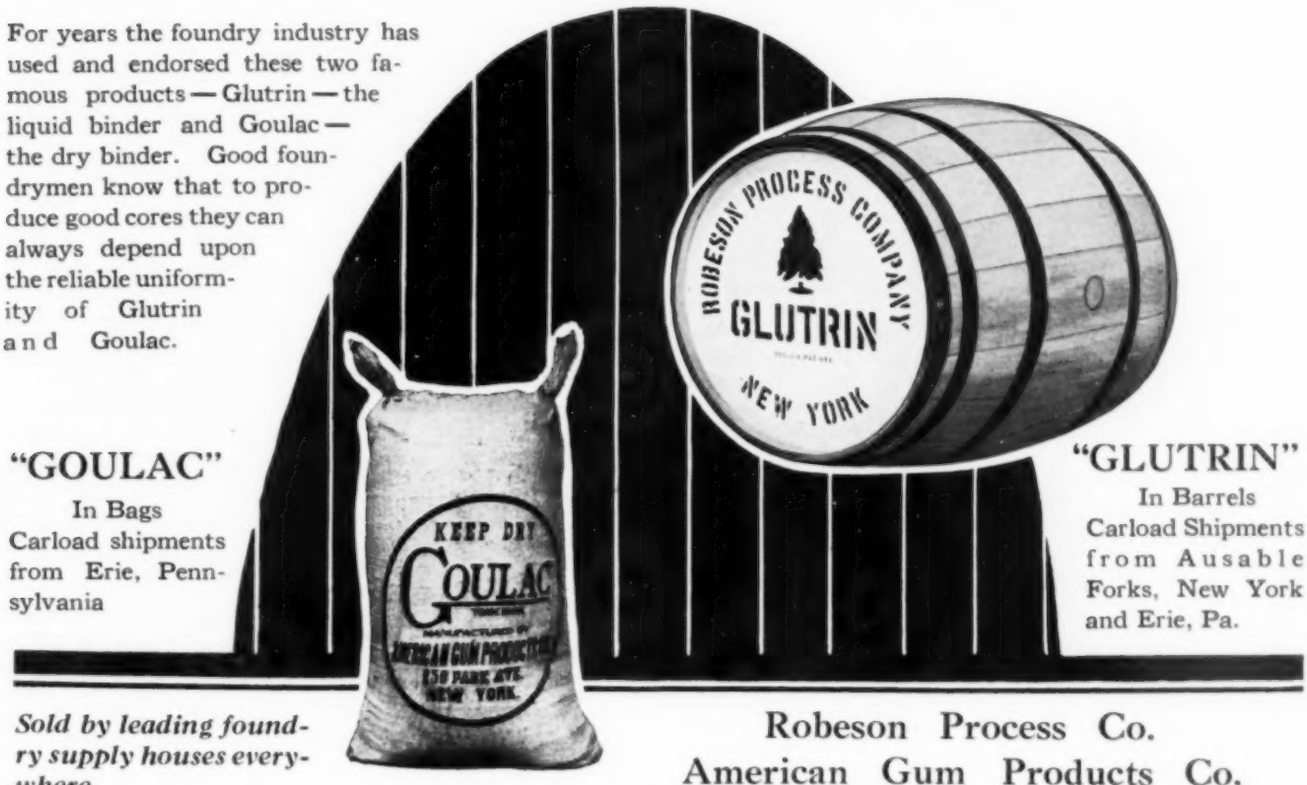
Attendance at the meeting of the association during the past season has been exceptionally good, according to a report of Louis G. Tarantino, secretary.

Publishes Statistics

The *American Metal Market*, New York, recently has issued the twenty-seventh annual edition of *Metal Statistics* for 1934. The volume contains general statistical information on the ferrous and nonferrous metals. B. E V. Luty and N. J. Langer are editors.

DON'T ACCEPT A SUBSTITUTE!

For years the foundry industry has used and endorsed these two famous products — Glutrin — the liquid binder and Goulac — the dry binder. Good foundrymen know that to produce good cores they can always depend upon the reliable uniformity of Glutrin and Goulac.



"GOULAC"
In Bags
Carload shipments from Erie, Pennsylvania

"GLUTRIN"
In Barrels
Carload Shipments from Ausable Forks, New York and Erie, Pa.

Sold by leading foundry supply houses everywhere.

Robeson Process Co.
American Gum Products Co.
230 Park Ave. New York

THE
BRITISH ALUMINIUM
CO. LTD.

VIRGIN ALUMINUM

U. S. AGENCY:

ARTHUR SELIGMAN
(Dept. F)
30 Rockefeller Plaza New York

"BRANFORD" VIBRATORS

Vibrator Flask Rapper
(above)

Vibrators for all Foundry uses
From 3/8" Plate Vibrators
to
8" Flask and Table Vibrators.

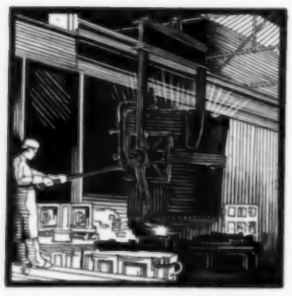
Valves, Fittings, Automatic Oilers—Complete Vibrator Fittings for Benches, Moulding Machines and Tubs.

New Department for Servicing Branford and Any Other Make of Pneumatic Vibrators.

Write for Catalog or Vibrator Information —Dept. 46

MALLEABLE IRON FITTINGS CO.
Branford, Conn., U. S. A.

New Equipment



For Foundries

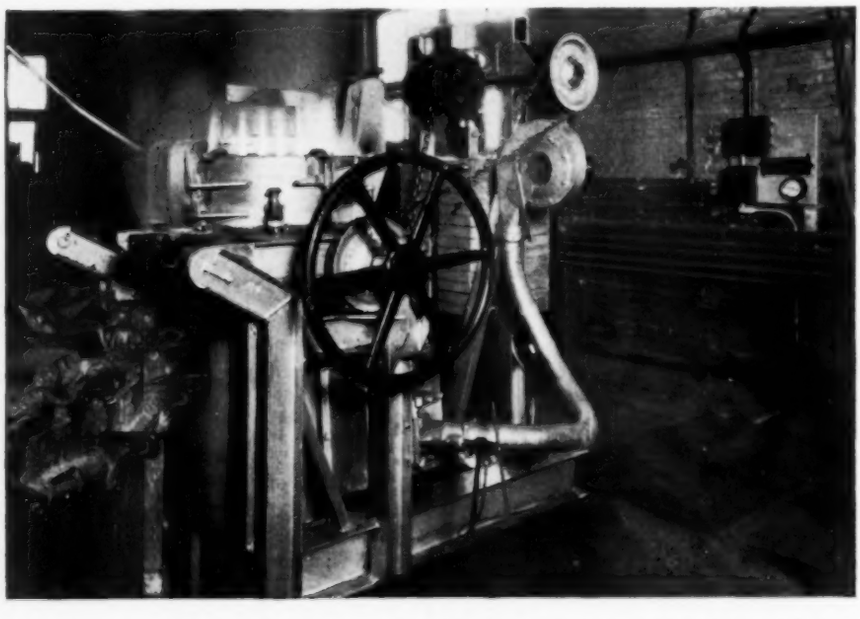
Combustion Rapid In Nonferrous Furnace

United Furnace Engineering Co., Inc., 90 West street, New York, recently has announced a new automatic melting furnace, which will be marketed under the name of Meltomat. The unit is an oil burning, crucible type furnace designed especially for melting nonferrous metals. The furnace is produced in either the stationary or tilting type, the latter being shown in the accompanying illustration.

The air supply unit is a fan blower direct connected to a motor, similar to the oil pump drive and operated from the same starting switch. Control of air volume is secured by a shutter at the blower intake. With any given motor speed and shutter opening, a constant volume of air is supplied through either a flexible or rigid duct to the burner, which is of special design and rugged construction.

Liquid oil, in passage under high pressure through the minute orifice, is atomized so that vaporization follows instantly. Atomization of the oil to the degree effected and mixture with the air supply, it is claimed, result in coincidental vaporization and combustion. Time for complete combustion and flame travel is exceptionally short. Rapidity and completeness of combustion make possible a relatively short combustion chamber. Combustion, it is claimed, is completed in the combustion chamber itself, thus providing in the melting chamber two important conditions of equalization of temperature and stable, uniform atmosphere. The interior contours of the melting chamber are designed so that burned gases entering from the combustion chamber are distributed properly. The combustion and melting chambers are lined with high grade plastic refractory materials, with high temperature insulation.

Either of two types of covers is available, one the conventional, circular single-piece cover with central exhaust port, and the other a flue type hopper cover. The latter forms an extension of the crucible, thus substantially isolating the metal charge from the heating gases, permitting metal charging in one operation if desired and extracting useful heat from the waste gases. The cover lifting mechanisms are of special design. The instrument panel consists of a high pressure gauge which indicates oil pressure at the burner, a furnace atmosphere indicator which is actuated by the flow of air in the supply duct, and a switch which controls operation of both oil and air supply motors.



The furnace is produced in either the stationary or tilting type, the latter being shown in the illustration

Grinder Designed For High Speed Wheels

Hammond Machinery Builders Inc., 1618 Douglas avenue, Kalamazoo, Mich., recently added a high speed grinder to its line. This unit was designed especially for high-speed wheels and can be supplied for a single motor drive for use with motors up to 15 horsepower.

Two independent spindles are embodied in the design and when used for single motor drive, the two inner ends of the spindles are coupled together with a combination coupling and V-belt pulley, making it possible to remove the belts by disconnecting the coupling without removing spindle from bearing housings. The grinder also is furnished as a two-spindle grinder, each spindle being entirely independent from the other and arranged for two motors, one for each spindle. Where each spindle can be used motors up to 7½ horsepower are suitable. With this arrangement, either spindle may be operated at different speeds from the other.

Removes Grease

Homestead Valve Mfg. Co., Coraopolis, Pa., recently has introduced a high pressure pump designed to remove grease, sludge oil, etc. from floors, walls, machinery and other equipment. The unit supplies water at 200 degrees Fahr. with nozzle velocity up to 175 pounds per square inch. When the hot water strikes the air it splashes into a vapor spray which is neither steam nor water but a constant combination of both. This pelts the surface to be cleaned with fine globules of water much like grains of sand in an air stream.

BUCKEYE SILICA FIRESTONE

SAWED CUPOLA BLOCKS

used in conjunction with

SPLIT ROCK LININGS

for resurfacing and patching the melting zone of your cupolas, will last indefinitely and afford double the protection of ordinary materials.

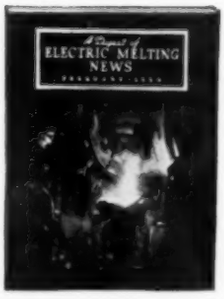
HAVE YOU INVESTIGATED THIS NEW COST SAVING METHOD?

BUCKEYE SILICA FIRESTONE comes in REGULAR RECTANGULAR SLABS which split straight and true to line, also sawed two, four and six sides straight and wedge shapes for lining Cupolas, Ladles, Converters, Soaking Pits, etc.

WRITE FOR BULLETIN No. 4

The CLEVELAND QUARRIES Company
Refractories Division
Builders Exchange Building
Cleveland, Ohio

The Month's News *about* ELECTRIC MELTING



Reduced to 8 pages of Quick, Easy Reading

We've read every important trade paper; selected the most pertinent articles about electric melting, high strength iron, and associated subjects, reduced them all to 8 pages of quick, easy, interesting reading. Send for your copy of the "Digest of Electric Melting News". No obligation.

DETROIT ELECTRIC FURNACE CO.
825 W. Elizabeth Street • Detroit, Michigan

C O U P O N

NAME_____

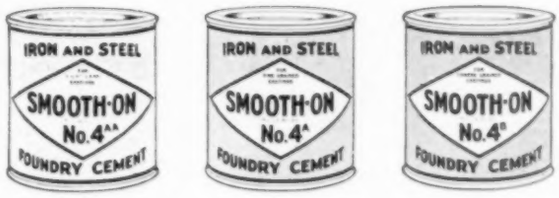
POSITION_____

FIRM_____

CITY_____ STATE_____

F

NEW and GOOD!



No. 4AA No. 4A No. 4B

The IMPROVED compositions of Smooth-On No. 4. Try them FREE

Smooth - On No. 4AA. For light gray castings and machined surfaces. Has high metallic lustre and takes a fine machine finish.

Smooth-On No. 4A. For medium gray castings. A fine grained cement that has a good metallic lustre.

Smooth-On No. 4B. For dark gray castings. A cement of coarser grain and darker shade.

THESE three *entirely new* compositions are our answer to the persistent demand for better metallic lustre, wider color variation and better match of both natural and machined surface.

These compositions applied in the usual way meet ordinary needs, but modification of lustre and shade is easily obtained by rubbing the *dry* powder on top of the applied filling. This lightens the shade.

The free *hardened* samples will show you that our improvement is striking, and application of the free *working* samples will prove that you *can* get perfect match—easily, quickly and cheaply.

FREE HARDENED and WORKING SAMPLES

Mail coupon for samples and prices. Smooth-On Nos. 4AA, 4A and 4B are packed in 1 lb. and 5 lb. cans, 25 lb. pails and 100 lb. kegs.

Smooth-On Mfg. Co., Dept. 17,
570 Communipaw Ave., Jersey City, N. J.

Please send *working* samples of
☐ Smooth-On No. 4AA ☐ Smooth-On No. 4A ☐ Smooth-On No. 4B
☐ Hardened samples of all three

Name.....

Address.....

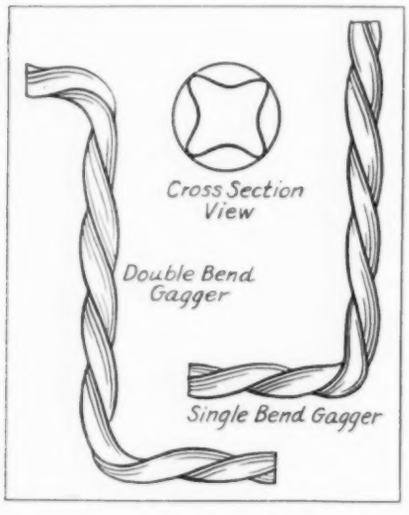
.....

5-34

***Do it with* SMOOTH-ON**

Develops Grooved Square Twisted Gaggers

Franklin Steel Works, Franklin, Pa., recently has introduced a line of grooved, square twisted, steel gaggers in sizes ⅜, ½ and ⅝ inches, single and double bend to any dimensions of leg, toe or hook desired. The gagger has been designed on the principal that the sand holding power is determined jointly by the cross



Gaggers are supplied with single or double bend to dimensions desired

sectional line of sand shear of the hole left by dislodgement, and by the volume or cross section of sand engaged by the gagger bar within the line of shear. The square twisted bar, when pulled from the sand, leaves a round hole the diameter equal to the circumscribing circle of the square, and the volume or cross section of sand engaged is the difference between the cross sectional area of the square bar and the area of the circumscribed circle, as shown in the accompanying illustration.

Liquid Parting Leaves Coating of Wax

Bloomsbury Graphite Co., Bloomsbury, N. J., recently has introduced a new liquid parting. This material, sold under the name of Misto, has as its base an oil which acts as a vehical to carry a special wax. In covering patterns this wax enters and seals the pores of the metal or wooden surfaces, leaving them smooth. Then the oil used as a vehicle can be wiped off. The wax provides a smooth clean surface to which it is claimed the sand will not adhere.

The company also points out that the material may be used as a cleaner for core boxes as it does not cut the shellac or varnish that is used on the box, and will not pit or mark the metal core boxes.

To apply, a paint brush is dipped in the material which then is worked into the parts of the pattern. Excess material then is removed with a cloth or by making one mold where the molding sand acts as a blotter. At the first sign of a few grains of sand adhering to the pattern, the molder again should apply the parting to the pattern.

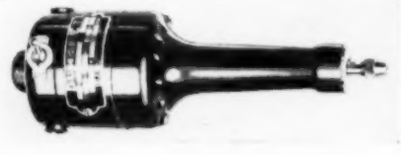
Introduces New Indicating Pyrometer

Foxboro Co., Foxboro, Mass., has introduced a new indicating pyrometer that uses the potentiometer system of temperature measurement. In this new pyrometer the pointer of the galvanometer swings just above the temperature dial and is brought to balance at the same hair line index which marks the measurement on the temperature scale. The hair line is part of a glass window through which both the pointer and the scale can be viewed at the same time. Because of this feature, balancing and reading the instrument are practically one operation.

The galvanometer has been designed sufficiently rugged to withstand industrial use without sacrificing accuracy and sensitivity. The instrument is mounted in a moisture proof case, and the unit may be either surface or flush mounted, depending on conditions of the installation.

Hand Grinder Built For Pattern Work

Dumore Co., Racine, Wis., has introduced a light weight, high-speed hand grinder for use by pattern, machine and engraving shops, and in toolrooms. The weight is only 1



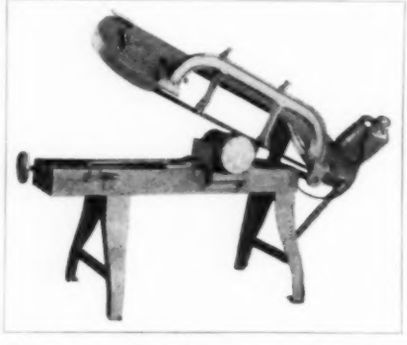
The grinder is light weight and operates at a high speed

pound and 10 ounces. A 1/40 horsepower universal type motor which can be used on either alternating or direct current furnishes power. A speed of 15,000 revolutions per minute is attained.

Edward T. Gushee, vice president and treasurer, Detroit Electric Furnace Co., Detroit, sailed for Europe in May.

Builds Band Saw For Cutting Metal Stock

Wells Mfg. Corp., Three Rivers, Mich., has introduced a band saw for cutting metals, as shown in the accompanying illustration. The saws are built in two sizes, one having a capacity of 4-inch round stock and the other a capacity of 8-inch round stock. The supporting frame or base is built with ample strength. The swivel vise on the larger machine is mounted on the supporting frame at a convenient height. It is so arranged that it will hold the work at any desired cutting angle and retain alignment without interference. The vise is of the quick-action type, which it



The vise will hold the work at any desired angle

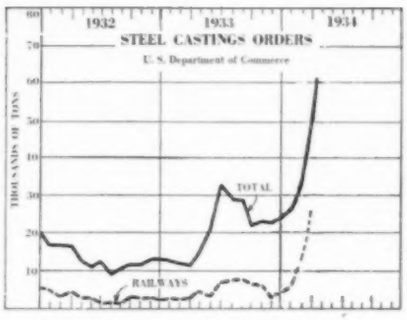
is pointed out saves time in chucking.

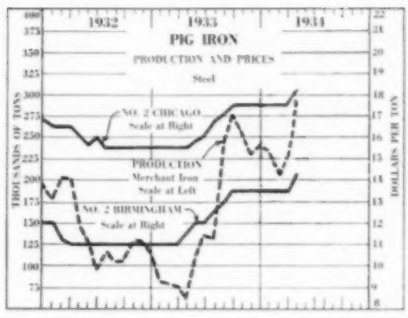
A constant-speed motor is mounted rigidly on the saw frame. Connections can be made to any available power or lighting socket. Power from the motor is transmitted directly to one of the two band saw wheels. In the larger model, helical gears provide a positive silent drive. All gears enclosed in the motor case are packed in grease. The band saw is carried on two band wheels, an idler and the driver. The wheels rotate on double annular ball bearings and are carried on plates so adjusted that the saw will not run off the wheels. An adjustable weight on the upper part of the saw frame and a spring on the motor end of that frame provide gravity feed. The switch is so arranged that the saw frame, moving down as the cut is made, automatically cuts off the power when it reaches the bottom position.

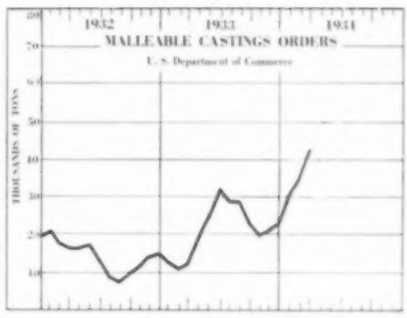
Made Manager of Turbo-BlowerDepartment

Batt L. Spain, for the past 24 years with the General Electric Co., West Lynn, Mass., as manager of turbo sales, now is connected with the Ingersoll-Rand Co. as manager of the turbo-blower department. His headquarters will be at 11 Broadway, New York.

ADVERTISING PAGES REMOVED







Foundry Activities

Reflect Industrial Trends

CHEVROLET MOTOR CO., Division of General Motors Corp., Saginaw, Mich., set a new record in its gray iron foundry by pouring 2152 tons of molten metal into castings in one day recently. During April the daily average of metal poured was 1787 tons.

* * *

Lambert Foundry Co. Inc., Greensboro, N. C., has been incorporated by A. B. Lambert and J. M. Sykes.

* * *

Knox Stove Works Co., Knoxville, Tenn., plans an addition to its foundry on Ailor avenue, 35 x 100 feet.

* * *

American Steel Foundry, East St. Louis, Ill., recently resumed operations after being closed since October, 1932.

* * *

Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., recently opened its Sanford street plant in Muskegon Heights.

* * *

St. Johns Foundry Co., St. Johns, Mich., recently has been purchased by John Spousta, of Owosso, Mich., and formerly connected with the St. Johns plant.

* * *

K and F Brass Foundry, Orrville, O., idle for the past 2 years has been leased to Robert R. Cairnie, formerly foreman of the Ohio Injector Co., Wadsworth, O.

* * *

International Harvester Co., 210 Teall avenue, Syracuse, N. Y., will add a 1-story addition to its local plant and install electric power equipment, at a cost of $100,000.

* * *

Index of foundry equipment orders for March reached 75.4, compared with 65.8 in February and 9.8 in March, 1933. The index of shipments in March was 62.6 and of unfilled orders 51.5.

* * *

Lakey Foundry & Machine Co., Muskegon, Mich., recently received a large order for cylinder block castings from the Chrysler Motors Corp. The No. 5 foundry of that company is working two 8-hour shifts full time.

* * *

Manufacturing operations for Joy Bros. Inc., which have been handled by the Kelly Foundry & Machine Works, Mount Gilead, O., have been transferred to Claremont, N. H., as the result of a sale of the former company to the Sullivan Machinery Co., Chicago.

* * *

The plant formerly operated by the J. L. Mott Co., Trenton, N. J., recently was sold to Harry A. Robinson of Philadelphia. The original J. L. Mott Co., before going into receivership in 1924, had been in business more than 100 years and was the third largest industry in Trenton.

* * *

Steel castings won out against welded steel construction when the Hardie-Tynes Mfg. Co., Birmingham, Ala., obtained the contract for twelve 84-inch needle valves for the Boulder dam power project. At the same time the Hardie-Tynes Co. booked the contract for twelve 96-inch emergency gates for the same project.

* * *

Lombard Iron Works & Supply Co., Augusta, Ga., recently leased the plant of the Textile Machinery Corp., Spartanburg, S. C., for the manufacture of textile castings. The statement in the April issue of THE FOUNDRY regarding the Lombard company resuming operations at its Augusta plant was in error, as that plant has been in continuous operation since 1869.

* * *

Activity in gray iron and steel foundries increased during March, according to reports received by the Industrial Research department of the University of Pennsylvania from foundries operating in the Philadelphia Federal Reserve Bank district. The increase in production was distributed among most of the reporting firms but was most significant in the steel foundries which reached their highest point in activity since

RAW MATERIAL PRICES
May 7, 1934

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.50
No. 2 foundry, Chicago	18.50
No. 2 foundry, Buffalo	18.50
Basic, Buffalo	17.50
Basic, Valley	18.50
Malleable, Chicago	18.50
Malleable, Buffalo	19.00
Charcoal iron, furnace	21.00
Coke	
Connellsville beehive premium	$5.35
Wise county beehive coke	3.50 to 4.25
Detroit by-product coke	8.75
Scrap	
Heavy melting steel, Valley	$13.00 to $13.50
Heavy melting steel, Pitts	13.25 to 13.75
Heavy melting steel, Chicago	11.25 to 11.75
Stove plate, Buffalo	10.75 to 11.00
Stove plate, Chicago	7.50 to 8.00
No. 1 cast, New York	8.25 to 8.50
No. 1 cast, Chicago	9.00 to 9.50
No. 1 cast, Pittsburgh	12.50 to 13.00
No. 1 cast, Philadelphia	12.50 to 13.00
No. 1 cast, Birmingham	10.00 to 10.50
Car wheels, iron, Pittsburgh	12.75 to 13.25
Car wheels, iron, Chicago	12.00 to 12.50
Railroad malleable, Chicago	12.25 to 12.75
Malleable, Buffalo	13.25 to 13.75
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	8.25
Straits tin	54.05
Aluminum, No. 12, producers	18.00 to 22.00
Aluminum, No. 12 remelt (Max. iron or zinc 1.0)	16.00
Lead, New York	4.25
Antimony, New York	8.70
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.35

October, 1931. Production of gray iron castings increased by 5.9 per cent over the previous month, the output of steel castings was 17.7 per cent greater than in February while the production of malleable iron castings decreased 9.3 per cent.

New Trade Publications

HELMETS—W. W. Sly Mfg. Co., 4704 Train avenue, Cleveland, has published an attractive folder on its helmet which is designed to safeguard the wearer against inhalation of injurious dust, regardless of fineness or concentration. It is pointed out that the helmet unit consists of the helmet proper, a filter and purifier with renewable cartridge, an air pressure reducer, a pressure gage, a skull cap, and air hose of the required length from the air line to the helmet. The unit may be used as protection against dust, fumes, smoke, etc.

SAFETY SHOES—Lehigh Safety Shoe Co., Allentown, Pa., has issued a folder illustrating and describing its line of steel box safety toe shoes for industrial workers. A special molder's shoe is included in the line.

CONTROLLED METAL. — Spring City Foundry Co., Waukesha, Wis., has published an interesting bulletin describing and illustrating the equipment utilized and practice followed in obtaining complete control of materials used in producing its line of gray castings.

THERMOMETERS — A resistance thermometer for measuring temperatures from minus 300 to plus 1000 degrees Fahr. is described in a catalog of the Brown Instrument Co., Philadelphia. The thermometers are available in indicating, recording and controlling types.

PUMPS—Ingersoll-Rand Co., Phillipsburg, N. J., has published a 16-page folder describing and illustrating its motor pumps which are built in 26 sizes ranging from ¼ to 30 horsepower and in capacities confined to 1000 gallons per minute. Tables of capacities and performance data are given.

REFRACTORIES—Plibrico Jointless Firebrick Co., 1800 Kingsbury street, Chicago, has published a catalog covering its line of jointless firebrick and other refractory products. Illustrations

Faked Foundry Facts

Bench Molder

show the method of installing the firebrick, as well as numerous installations. Mining and preparation of the material also are discussed.

HEATERS—General Electric Co., Schenectady, N. Y., has published a 52-page catalog on its line of electric heating units and devices. Information is presented on immersion, strip and spot heating units. Information on the installation of the various units to a wide variety of uses is presented through the text and many drawings.

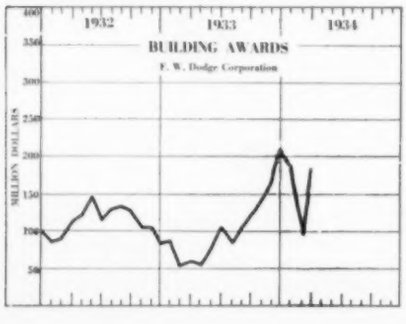
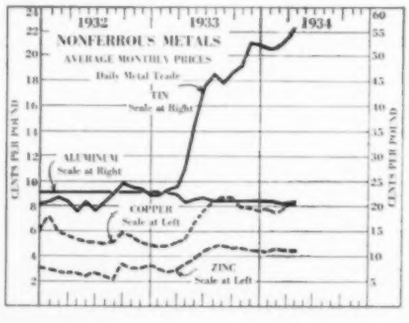
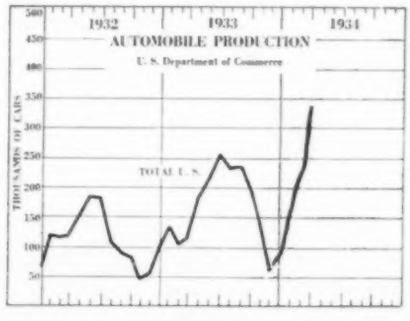
COMPRESSORS — Gardner-Denver Co., Quincy, Ill., recently has published a bulletin on its duplex-horizontal compressors for compressing air or gas. Information is presented on the design and construction of the various parts of the compressor and data are given on the sizes and capacities of direct connected and belt driven units available.

CORE BINDERS—Hercules Powder Co., Wilmington, Del., has published a folder describing the properties and applications of its core binder, a product of the naval stores department. The pamphlet tells of the use of the resinous material as a dry binder and in oil sand cores. A chart shows the tensile strength of cores when varying amounts of oil and the binder are used.

HEATING UNITS—Edwin L. Wiegand Co., 7500 Thomas Boulevard, Pittsburgh, recently has published a catalog illustrating and describing its various types of heating units and presenting tables and charts to assist in the selection of the proper type, size and rating of heaters for particular needs. Illustrations show a number of interesting applications of that type of equipment.

PHOTOELECTRIC RELAY—A recent folder of the General Electric Co., discusses the application of the photoelectric relay to applications in which the operating light beam is intercepted completely by an object which is practically opaque. It is pointed out that the equipment is especially adapted to the operation of magnetic counters for counting applications not exceeding 400 counts per minute.

INSULATION—Johns-Manville Corp., 22 East 40th street, New York, has published in booklet form a lecture used in schools of mechanical, chemical, metallurgical and ceramic engineering. The text comprises a short review of principles of heat transfer, a discussion of the theory and practice of conductivity values of insulation and refractories, insulation in boilers, kilns, furnaces and other types of industrial equipment operated at high temperature. A standard formula for heat transfer by conduction and a description of the method of determining heat flow through furnace walls also are included.

FURNACES—Standard Fuel Engineering Co., 667 Post avenue, south, Detroit, recently has published three bulletins dealing with various furnaces. Bulletin No. 26 discusses large oven furnaces, either gas or oil fired, for annealing, carburizing, heat treating and hardening. Bulletin No. 27 describes and illustrates pot furnaces for cyanide salt bath, lead hardening and metal melting, while bulletin No. 28 deals with small oven furnaces for tool steel, annealing, preheating and drawing. Sizes and specifications are given in each case.

TESTING MACHINES—A bulletin of the Tinius Olsen Testing Machine Co., Philadelphia, describes and illustrates four machines, one of 50,000 pounds capacity for testing long tension or compression members, a second with capacities from 30,000 to 40,000 pounds which is of a three-screw rotating gear nut type equipped with eight speed gear box drive, the third having 30,000 to 40,000 pounds of capacity of four screw rotating gear nut type and the fourth having a capacity from 10,000 to 20,000 pounds designed for testing bulky material in compression.